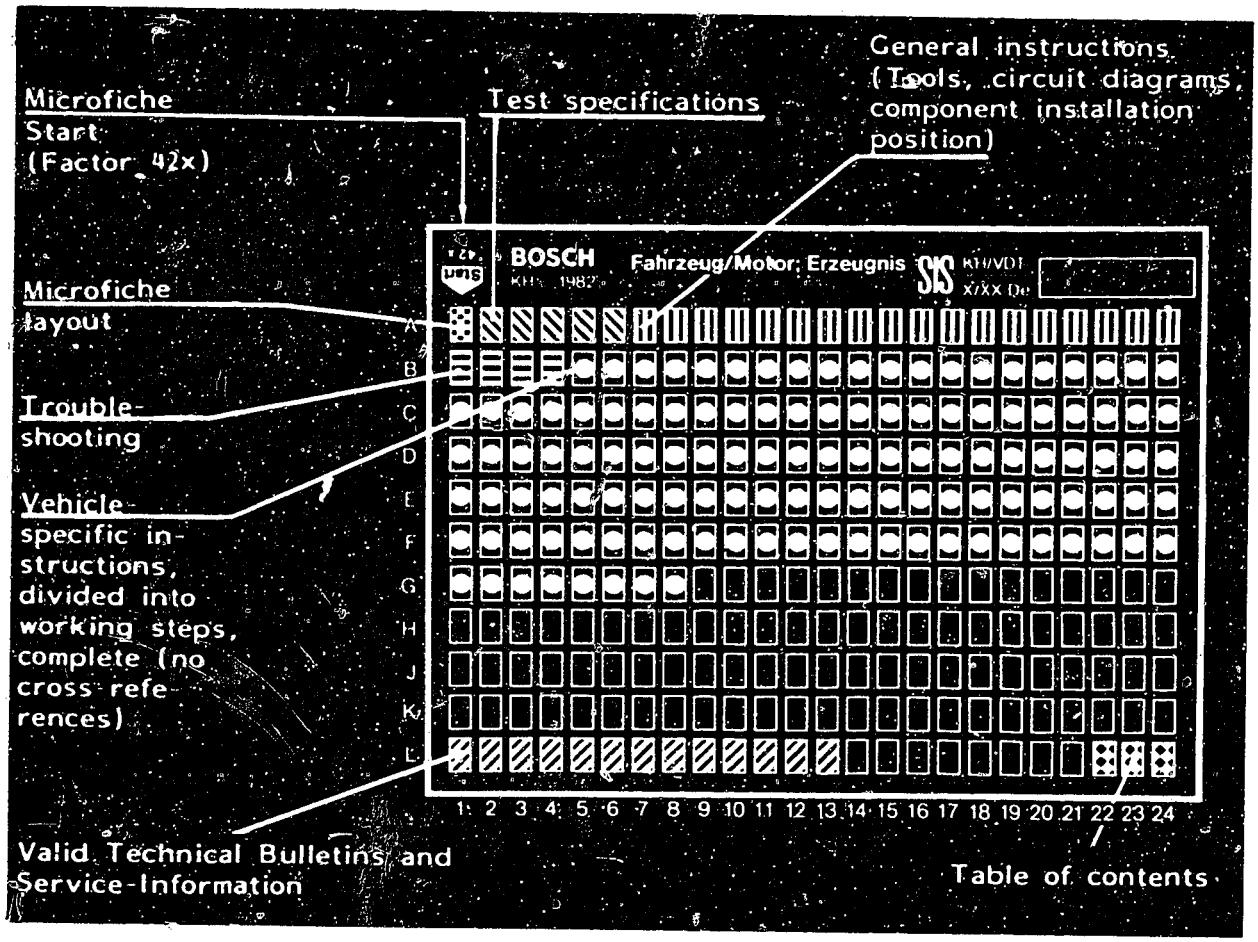
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar. |

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

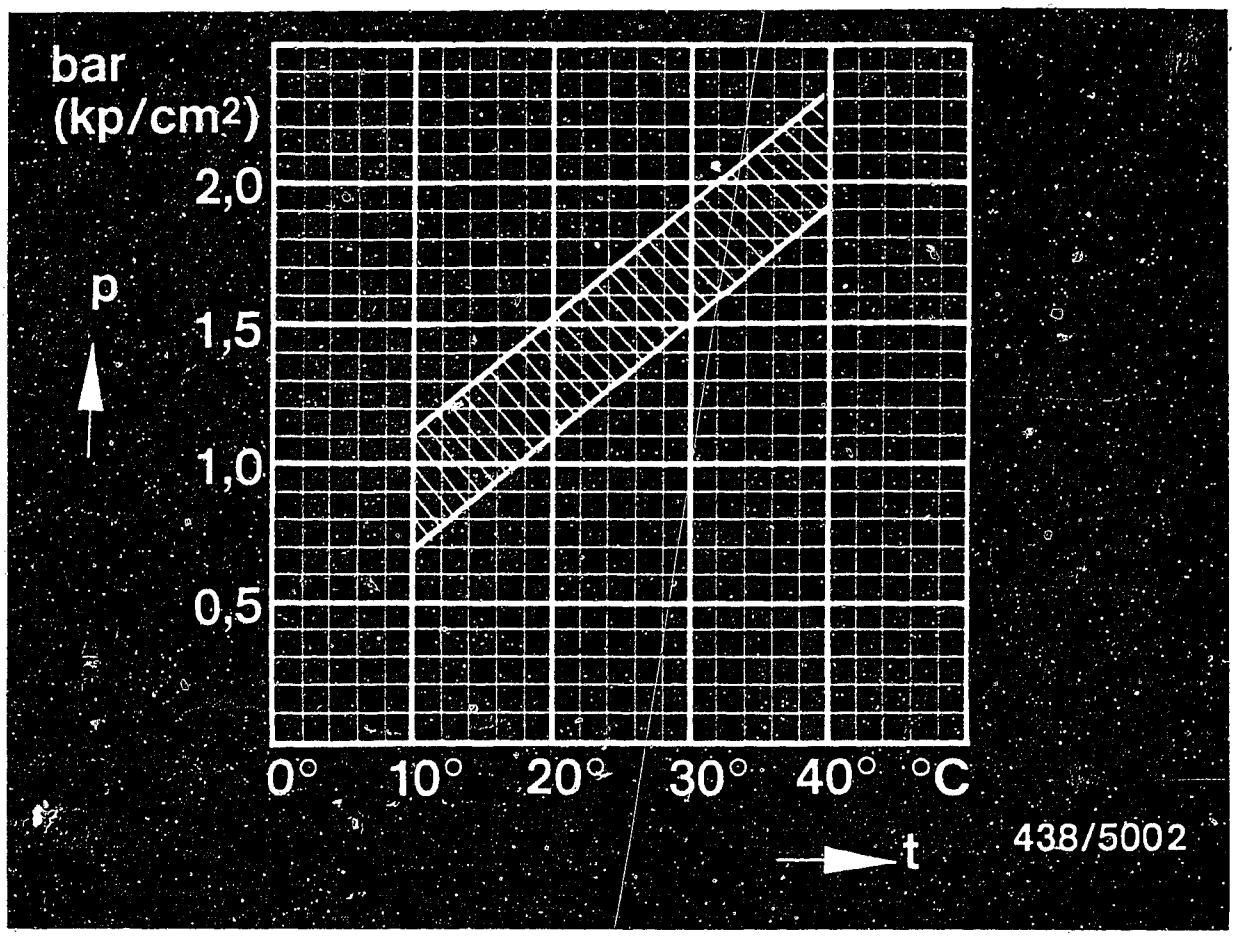
C6

1. Test specifications

1.1 Electric fuel pump

C1

Test step	Test specifications
Fuel delivery	min. 930 cm^3/30 s



p = Control pressure (gauge pressure)
t = Ambient temperature

1.2 Control pressure "Cold"

C11

For testing, connect vacuum pump to intake-manifold-pressure connection of warm-up regulator.

Setting value: 510...550 mbar
(385...415 mmHg)

Part no. of warm-up regulator: 0 438 140 038

(Version for intake-manifold-pressure-controlled full-load enrichment)

Test step	Test specifications*

1.3 Control pressure "Warm"

C11

Part no. of warm-up regulator: 0 438 140 038
(Version for intake-manifold-pressure-controlled full-load enrichment)

- Test at atmospheric pressure
  (Without vacuum): 3.0...3.4 bar (3.1...3.5 kgf/cm^2)

- For testing, connect vacuum pump to intake-manifold-pressure connection of warm-up regulator.

  Setting values:
  510...550 mbar
  (385...415 mmHg): 3.4...3.8 bar (3.5...3.9 kgf/cm^2)

- Leak test on full-load diaphragm
  Maximum pressure drop from setting value: 100 mbar (75 mmHg)/15s

*Pressures in the test-specification table are given in bar (gauge pressure) and/or in kgf/cm^2 (gauge pressure).

Test step	Test specifications*

D4

1.4 Primary pressure

Fuel distributor 0 438 100 025

Checking value: 4.5 ... 5.2 bar (4.6 ... 5.3 kgf/cm²)
Setting value: 4.7 ... 4.9 bar (4.8 ... 5.0 kgf/cm²)

D12

1.5 Leak test

	Fuel accumulator 0 438 170 007
Minimum pressure	
after 10 minutes	2.0 bar (2.1 kgf/cm²)
after 20 minutes	1.7 bar (1.8 kgf/cm²)

E5

1.6 Injection valves

Part number 0 437 502 011

Opening pressure 2.5 ... 3.6 bar (2.6 ... 3.7 kgf/cm²)

* Pressures in the test-specification table are given in bar (gauge pressure) and in kgf/cm² (gauge pressure)

E16

1.7 Fuel distributor

Delivered-quantity comparison

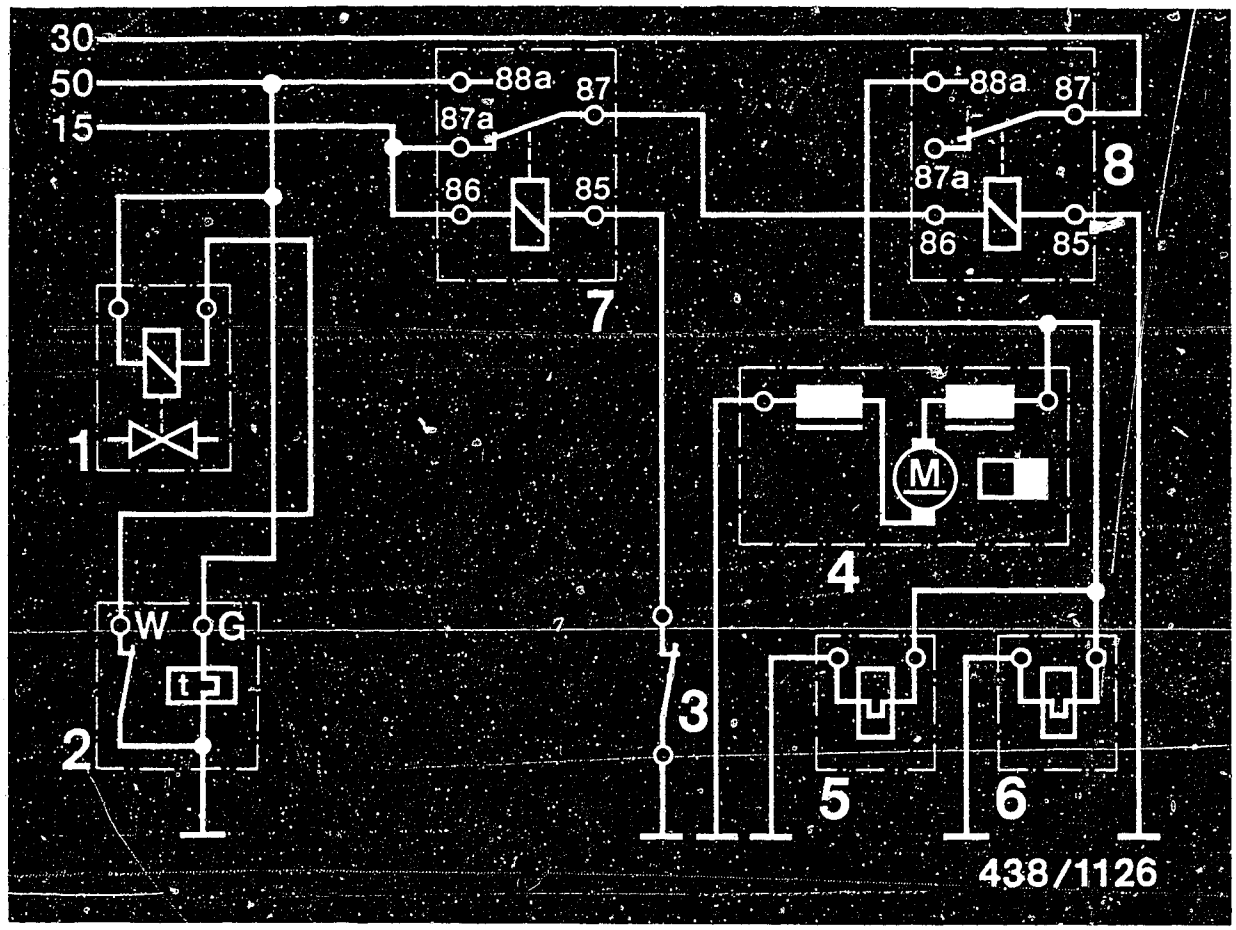
Fuel distributor
Part No. 0 438 100 025
0 438 100 080

	Setting Point cm³/min	Max.allowable delivery cm³/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	145.0	158.0

F6

1.8 Idle adjustment

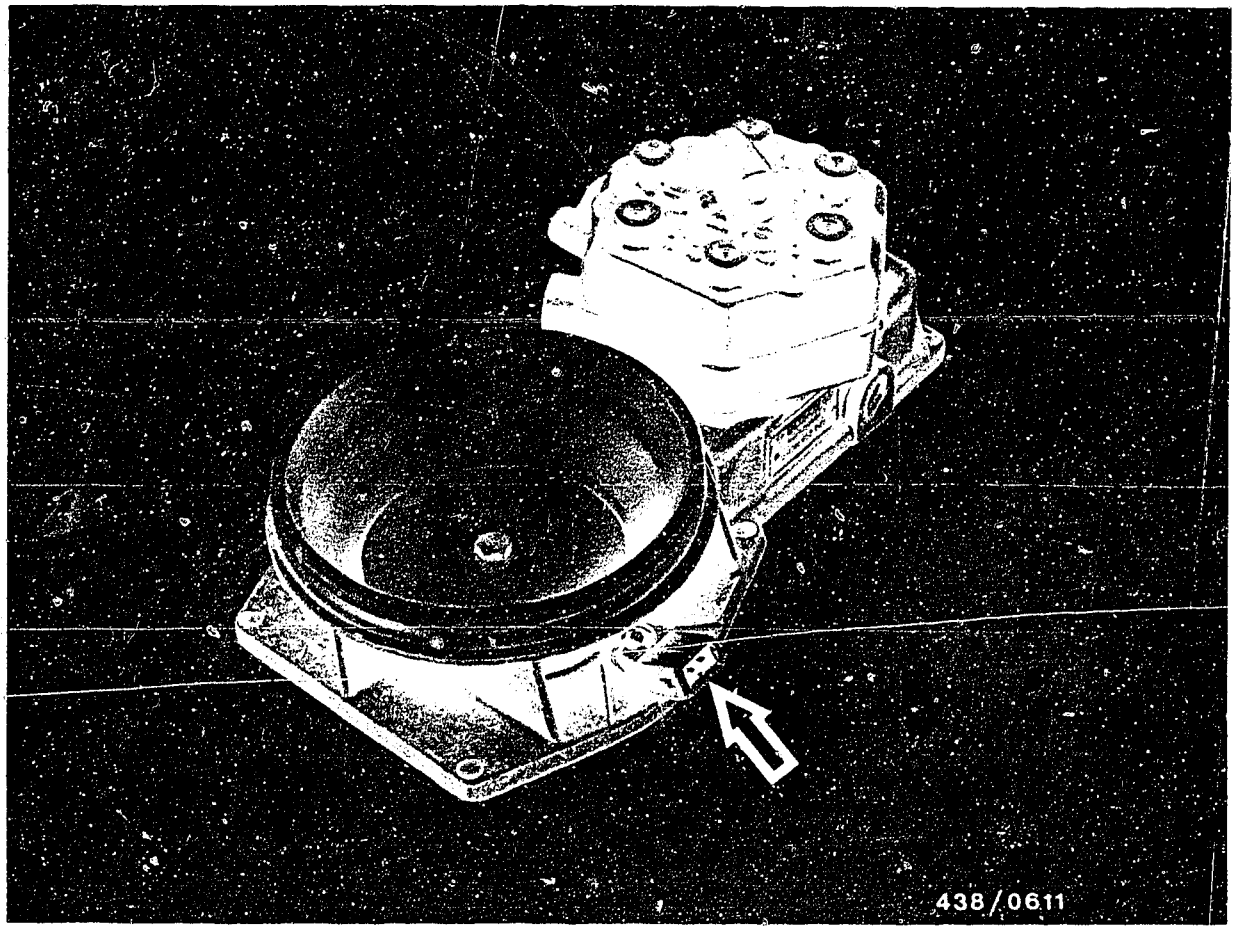
- Idle speed: 775 ... 825 min^{-1}
- CO concentration (% by vol.) 2.0 ... 2.5



1 = Start valve
2 = Thermo-time switch
3 = Safety contact in air-flow sensor
4 = Electric fuel pump
5 = Warm-up regulator
6 = Auxiliary-air device
7 = Relay 1
8 = Relay 2

2. Electrical safety circuit

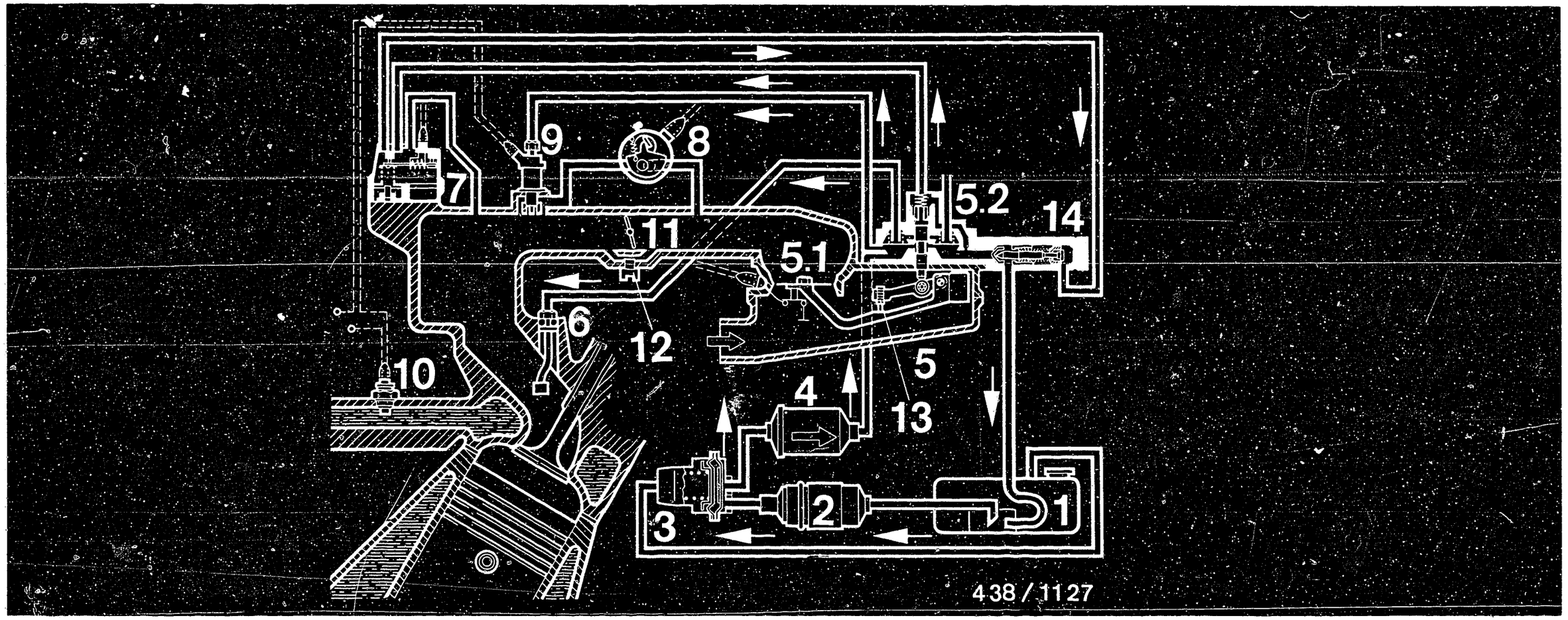
2.1 Circuit diagram



2.2 Bridging the safety circuit

In order to bridge the safety circuit it is sufficient to switch on the ignition and to remove the double connector from the socket on the air-flow sensor (arrow).

The components electric fuel pump, warm-up regulator and auxiliary-air device are triggered via relays I and II whereby the ignition must be on and the contact in the air-flow sensor open air-flow sensor plate raised.



3. Diagrams

3.1 Diagram of fuel lines

1 = Fuel tank
2 = Electric fuel pump
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5.1 = Air-flow sensor
5.2 = Fuel distributor
6 = Injection valve
7 = Warm-up regulator
8 = Auxiliary-air device
9 = Start valve
10 = Thermo-time switch
11 = Throttle valve
12 = Idle-speed-adjusting screw (bypass)
13 = Idle-mixture screw
14 = Primary-pressure regulator with push valve

4. General information

4.1 Introduction:

This repair instruction manual relates to the Ford vehicle model Granada 2.8 i, 9.76 ... 6.77 date of manufacture (1977 model).

All the system components are dealt with in separate working steps with the corresponding test specifications.

In addition to this repair manual the appropriate testing and repair manuals will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other known fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in this manual - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 1 - B 4 is intended to make it easier to decide which test steps have to be carried out for certain faults.

Choose the possible cause in the trouble-shooting chart in accordance with the complaint stated by the customer or which you yourself have determined. The coordinate at the end of the cause column refers to the appropriate test step with corresponding test specification.

Important note:

If any fuel connections are loosened, parts removed, also on the vacuum system, always use new seals when re-connecting or re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Fuel connections must be cleaned thoroughly on the outside before opening.

4.2 Design

The entire system of the K-Jetronic in the Ford Granada corresponds to the basic design as described in Technical Instruction VDT-U 3/1.

A special feature is the injection valves. The 1977 model Granada is the only vehicle with K-Jetronic which has bent injection valves. However, they operate in exactly the same manner as the known, straight K-Jetronic injection valves. The method of testing and of connecting the tester for delivered quantity comparison are likewise the same as for the straight-type injection valve.

4.3 Electrical safety circuit

The electric fuel pump, warm-up regulator and auxiliary-air device are energized by 2 relays whereby the switching of the control relay is dependent on the safety contact in the air-flow sensor (sensor-plate stop).

As usual, the start valve is energized by the thermo-time switch during cold starting according to the engine temperature.

5. Test equipment and tools

- Pressure tester KDJE-P 100 (previously KDEP 1034)

  For testing all fuel pressures and testing for leaks.

- Adjusting wrench KDEP 1035

  For adjusting the idle-mixture-adjusting screw in the mixture-control unit (CO adjustment).

- Guide ring KDEP 1040/10 (dia. 80 mm)

  For centering the air-flow sensor plate in the air-flow sensor.

- Tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451)

  For comparing the fuel delivered from the individual fuel-distributor outlets.

- Electric connecting cable (test lead)

  KDJE 7450/70 for the direct connection of components to be tested, e.g. cold-start valve.

- Graduate (commercially available, approx. 1.5 l capacity)

  For measuring the delivery of the electric fuel pump.

- Valve tester KDJE-P 400 (previously KDJE 7452).
  For testing the injection valves.

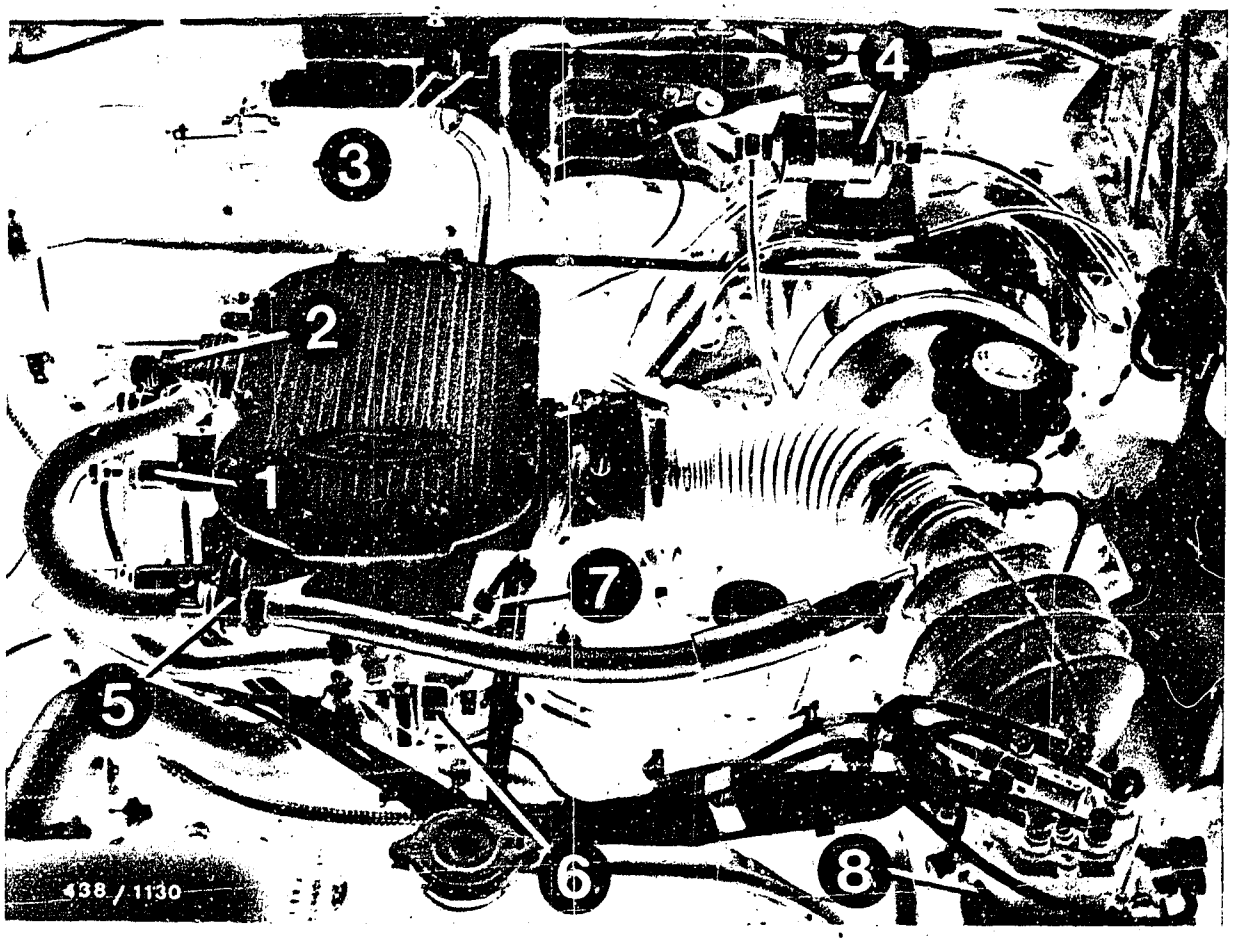
Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135) or
Bosch order designation VS 14 942-CH
previously part number 5 973 340 650
The Bosch calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids. Even with calibrating fluid, be sure to observe the local official regulations.

- Tachometer (commercially available).
  For idle-speed adjustment.

- CO meter (commercially available).
  For idle-speed CO adjustment.

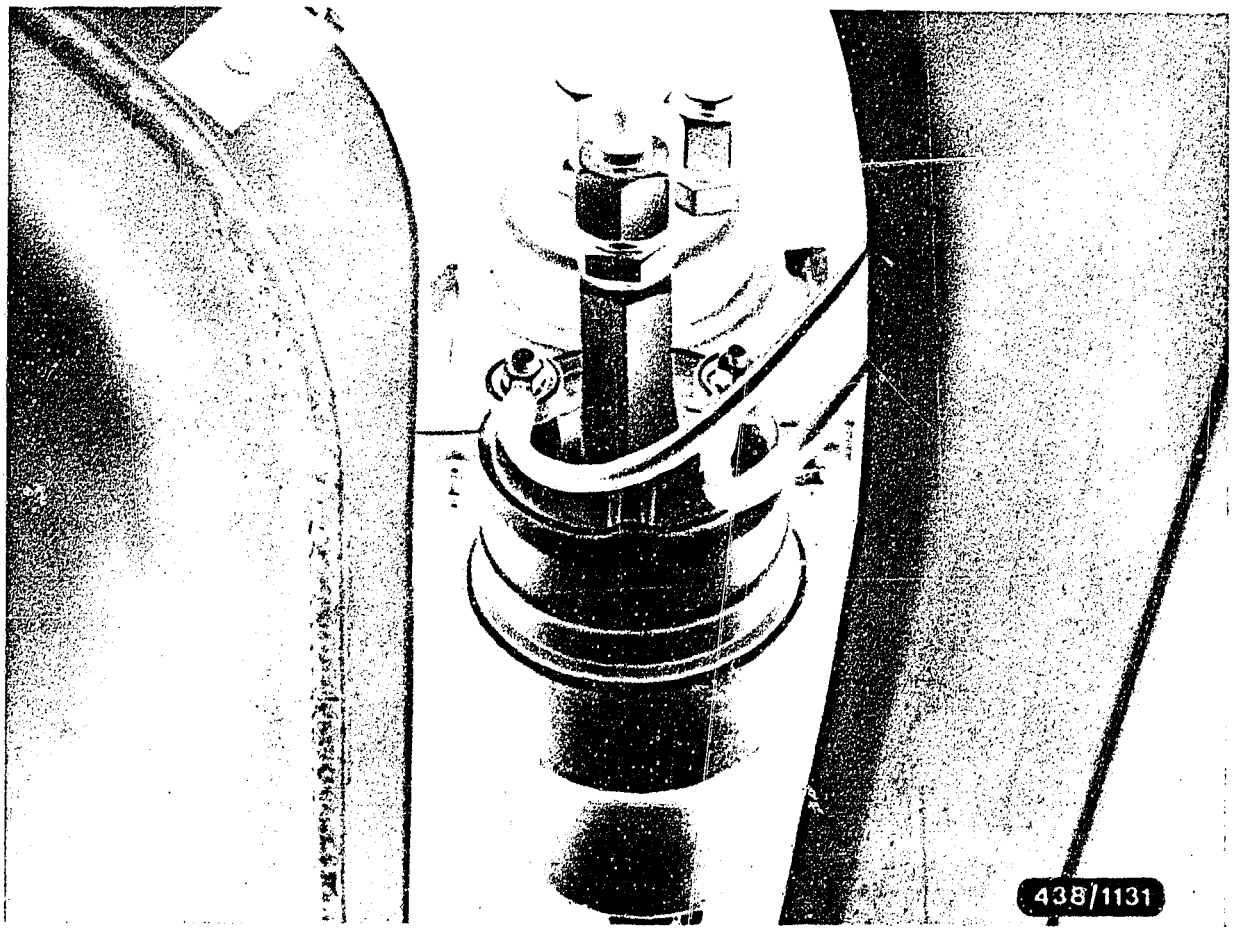
- Vacuum pump (commercially available).
  For testing warm-up regulators with intake-manifold-pressure-dependent full-load enrichment.
  e.g. Hand vacuum pump "Mityvac" from
  Firma Korinth
  Ludwig-Kloos-Straße 21
  6450 Hanau 7 (Steinheim)



1 = Start valve
2 = Warm-up regulator
3 = Relays 1 and 2 of electrical safety circuit
4 = Fuel filter
5 = Auxiliary-air device
6 = Thermo-time switch
7 = Injection valve (others hidden)
8 = Mixture-control unit

6. Installation position of individual components

Installation position of components on engine.



The electric fuel pump and fuel accumulator are on a common bracket on the underside of the vehicle, to the right of the fuel tank.

Both components are protected by a dirt-deflector plate which has been removed in the picture.

7. Trouble-shooting chart (see also coordinates B3/B4)

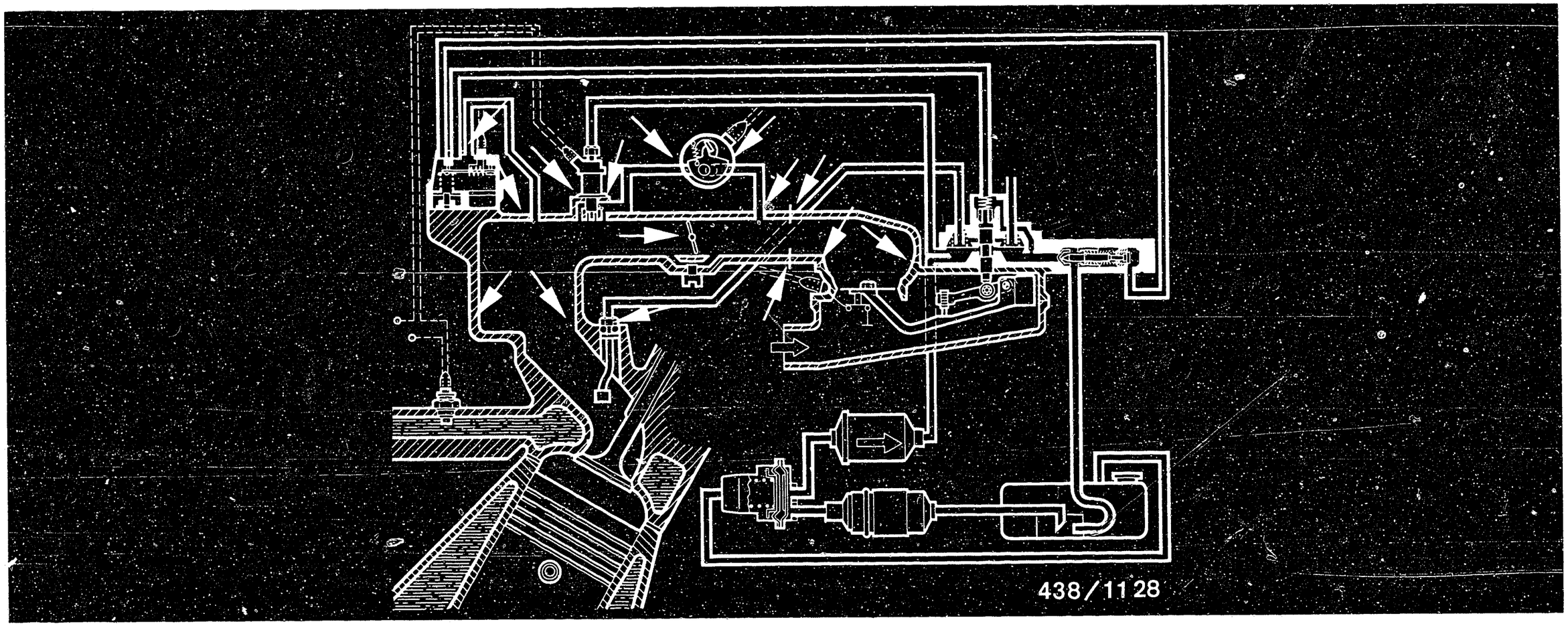
Customer complaint (fault symptom)

1. Engine does not start, or starts poorly, in cold condition
2. Engine does not start, or starts poorly, in warm condition* (hot-starting difficulties)
3. Irregular idling during the warm-up phase (shakes)
4. Irregular idling with warm engine (shakes)
5. Engine does not draw gas, burbles
6. Engine misfires when operating on the road, high load
7. Insufficient power

1	2	3	4	5	6	7	Cause	Coordinates
	●	●	●	●		●	Vacuum system leaking	B 5
●	●		●	●	●	●	Air-flow sensor lever and/or control plunger not moving smoothly	B 7
	●						Position of the air-flow sensor plate incorrect	B 17
●		●					Auxiliary-air device does not open	B 22
●	●				●		Electric fuel pump not operating	C 1
●							Cold-start system defective	C 5
		●	●				Cold-start valve leaking	C 7
				●			Excessive fuel delivery for control-pressure circuit	C 12
●		●					"Cold" control pressure outside tolerance	C 9
	●		●	●	●	●	"Warm" control pressure too high (after warm-up)	C 9
			●	●		●	"Warm" control pressure too low (after warm-up)	C 9
					●	●	Primary (system) pressure outside tolerance	D 4
	●						Overall fuel system leaking	D 12
●	●	●	●		●		Injection valves leaking, opening pressure too low	E 9
●	●	●	●			●	Unequal fuel delivery (imbalance of fuel delivery)	E 18
●	●	●	●	●			Basic CO adjustment incorrect	F 6
						●	Throttle plate does not open completely	F 6

*Note
If, in the case of Symptom 2, after checking and repairing all the fault causes listed below, the hot-start characteristic is still unsatisfactory this can be improved by fitting an impulse relay.
The fitting of this relay is described in Coordinate L5.

8. Engine runs on after being switched off ("diesels")	9. Fuel consumption too high	10. Flat spot during acceleration	11. CO concentration during idling too high	12. CO concentration during idling too low	13. Idle-speed cannot be adjusted (too high)	14. Engine starts but then immediately stops	Cause	Coordinates
		●		●			Vacuum system leaking	B 5
●		●	●	●			Air-flow sensor lever and/or control plunger not moving smoothly	B 7
●							Position of the air-flow sensor plate incorrect	B 17
					●		Auxiliary air device does not close	B 22
						●	Electric fuel pump not operating	C 1
●	●			●			Cold-start valve leaking	C 7
		●				●	Excessive fuel delivery for control-pressure circuit	C 12
		●				●	"Warm" control pressure too high (after warm-up)	C 9
	●	●	●			●	"Warm" control pressure too low (after warm-up)	C 9
		●				●	Primary (system) pressure outside tolerance	D 4
●							Injection valves leaking, opening pressure too low	E 9
		●					Unequal fuel delivery (imbalance of fuel delivery)	E 18
●	●	●	●	●			Basic CO adjustment incorrect	F 6



Working steps

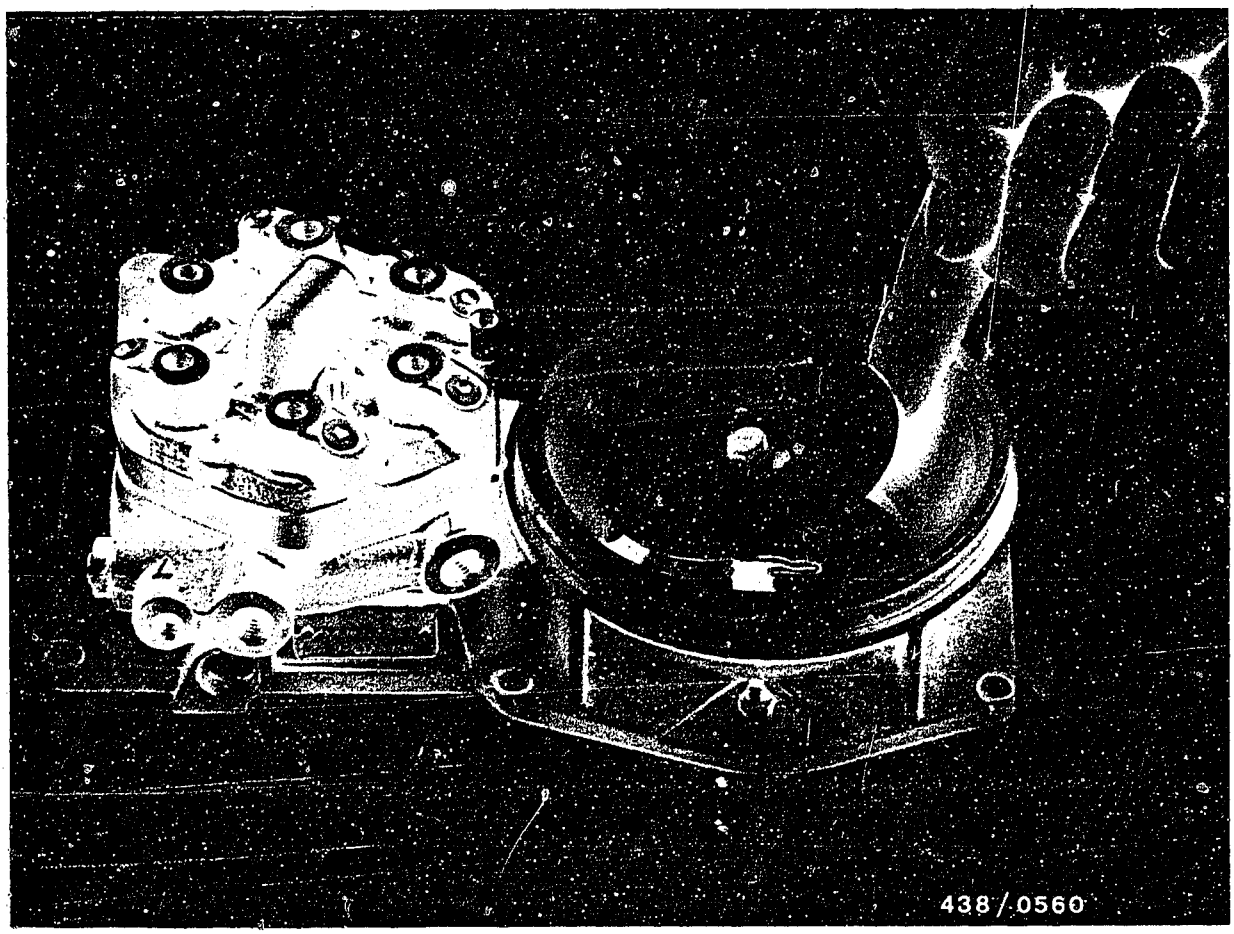
8. Check the air-intake system (vacuum system) of the engine for leaks.

The arrows in the diagram show typical points where leaks can occur. Check by performing a visual inspection or, in cases of doubt, as follows: Disconnect the hose from the outlet of the auxiliary-air device and blow air through this hose into the intake system using a compressed-air gun. The throttle valve is to be fully open. Brush connection points with soapy water, or spray with leak detector (e.g. Güpoflex). Under no circumstances may combustible liquids be used when testing for leaks.
The formation of bubbles or foam indicates a leak.
If a leak has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F6.

9. Check the control lever in the air-flow sensor and the control plunger in the fuel distributor for ease of movement.

9.1 Preparations

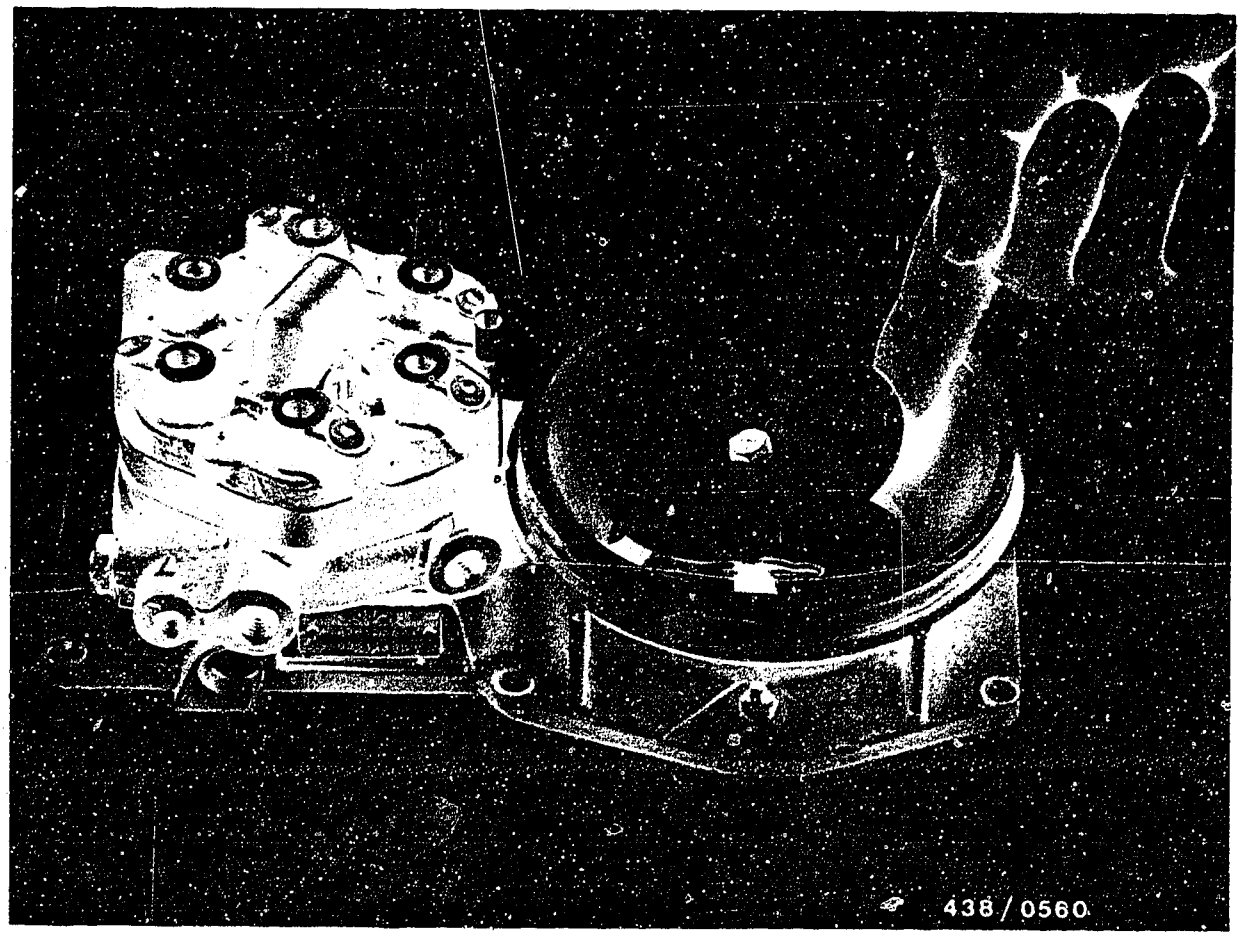
- Engine temperature not below +20°C.
- Remove the rubber hood so that the air-flow sensor plate becomes accessible.
- Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
  This results in application of the control pressure to the control plunger in the fuel distributor.



9.2 Check that the control lever moves freely

Raise the air-flow sensor plate by hand (updraft) and release again. The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop. If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.

If, when the fastening screws are loosened, the control lever now moves freely, replace the seal between air-guide housing and air-flow sensor (Ford service part). Uniformly tighten fastening screws cross-wise.
If there is no housing deformation, repair or replace the air-flow sensor.



9.3 Check that the control plunger moves freely.

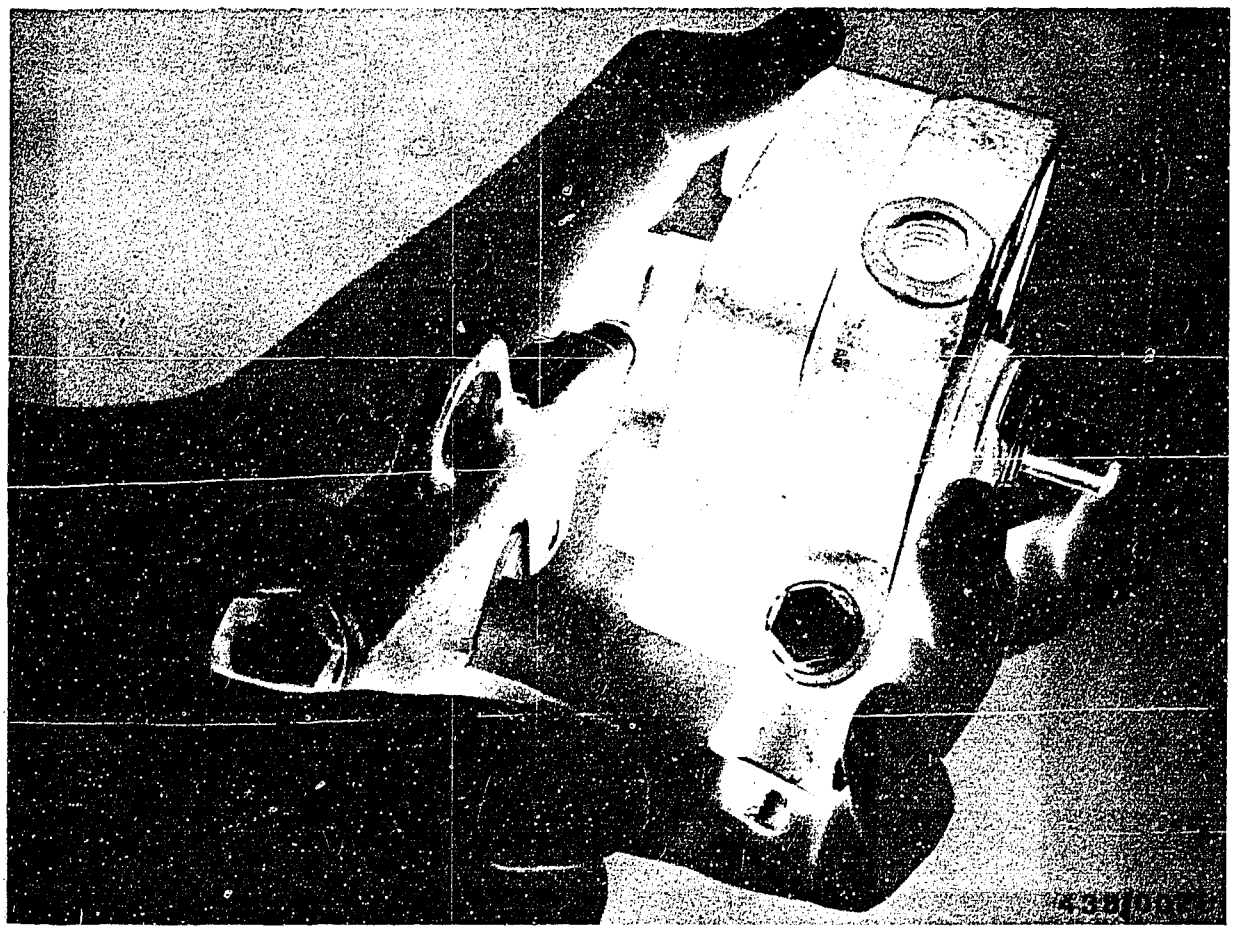
Raise the air-flow sensor plate by hand (updraft). The same resistance must be felt over the entire movement. Move the sensor plate rapidly back to a position just in front of the zero stop. The control plunger follows only sluggishly, but must make noticeable contact with the sensor plate lever. If this condition is fulfilled, the control plunger can be considered to move freely. If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

Important!
Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

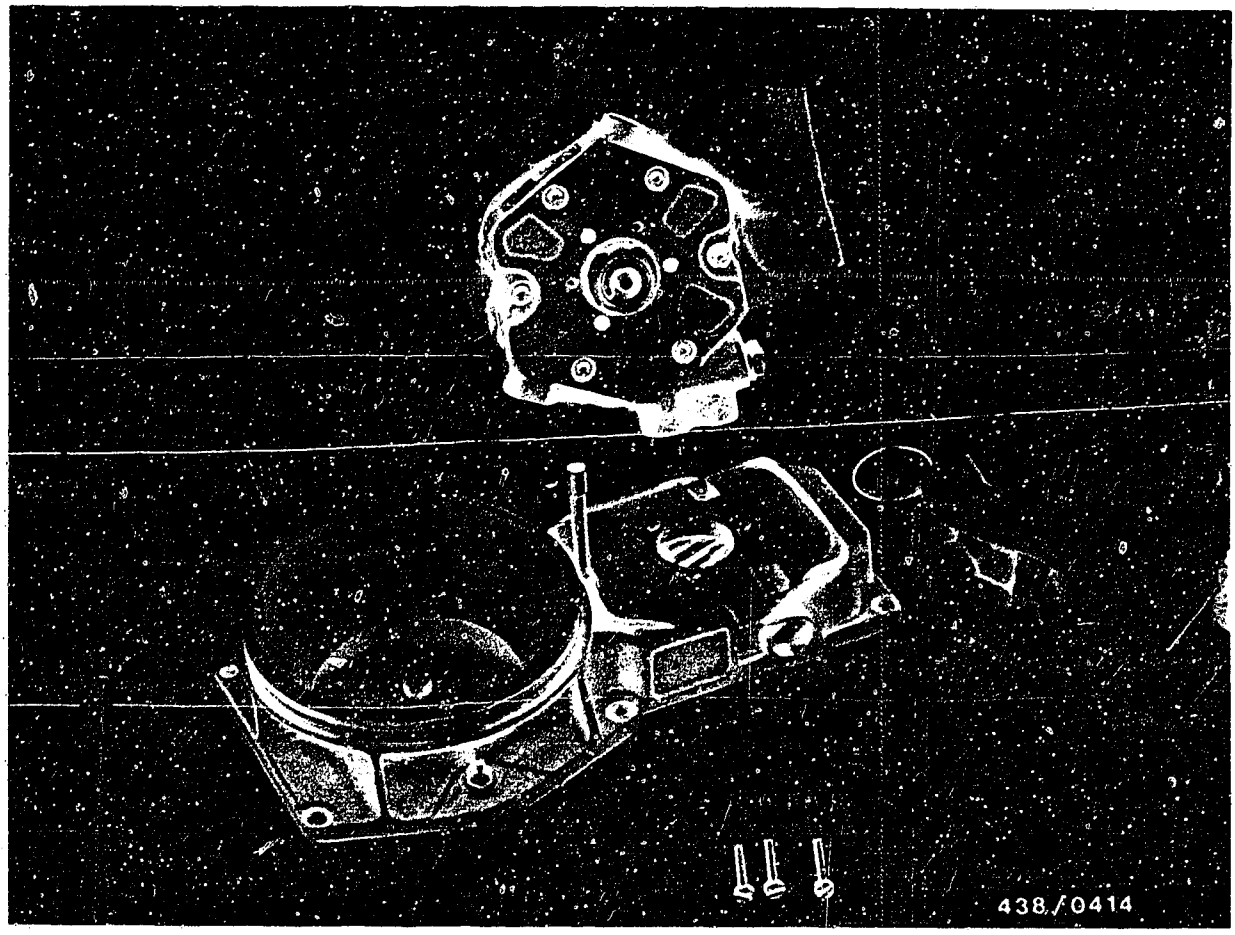
When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.



Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.

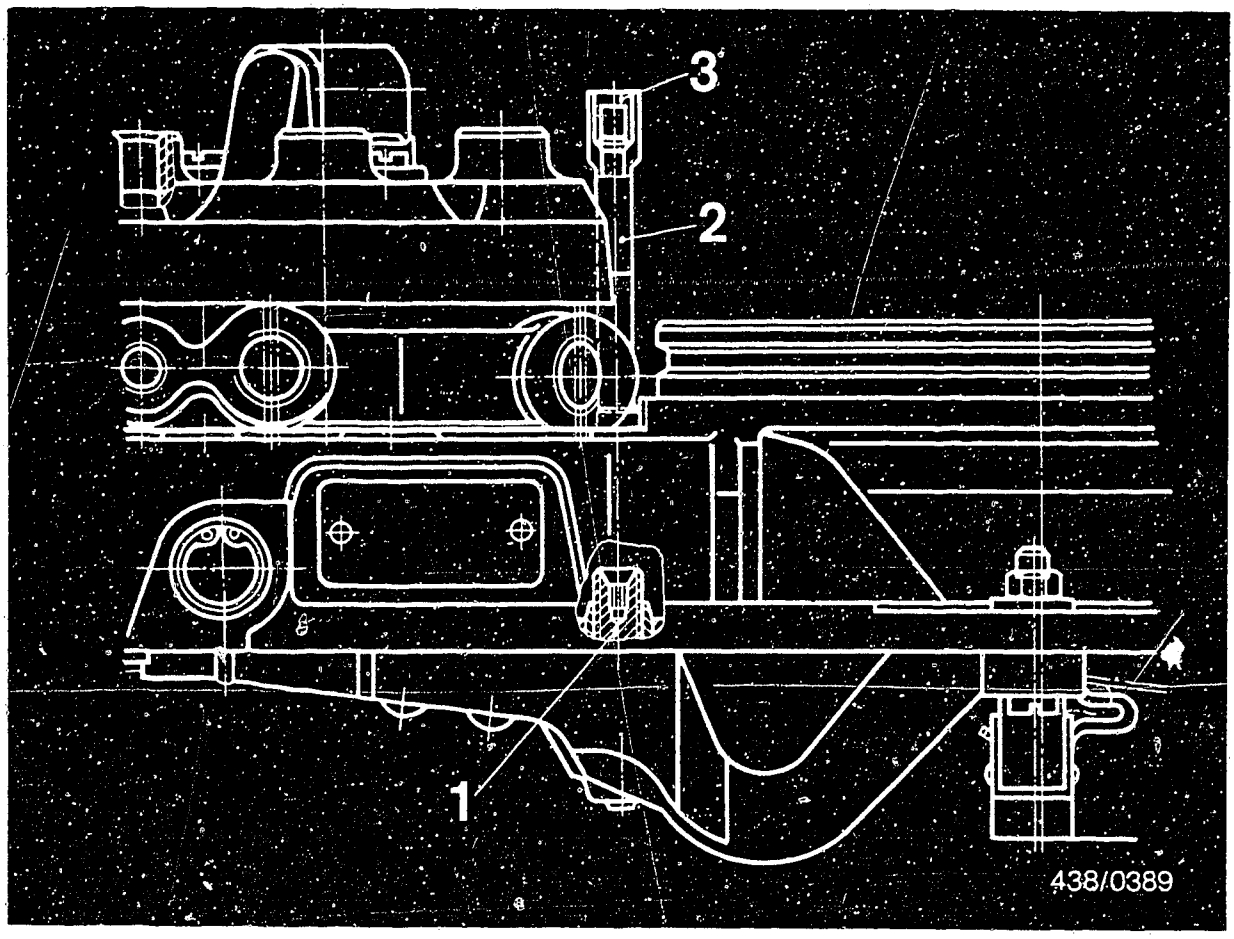
Remove the plunger. Under certain conditions, in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with benzine. If the plunger still does not move freely, replace the fuel distributor



9.4 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor. Observe the tightening torque 3.2...3.8 Nm (0.32... 0.38 kgfm) for the fastening screws precisely.

When connecting the fuel-injection tubing, use new seal rings.

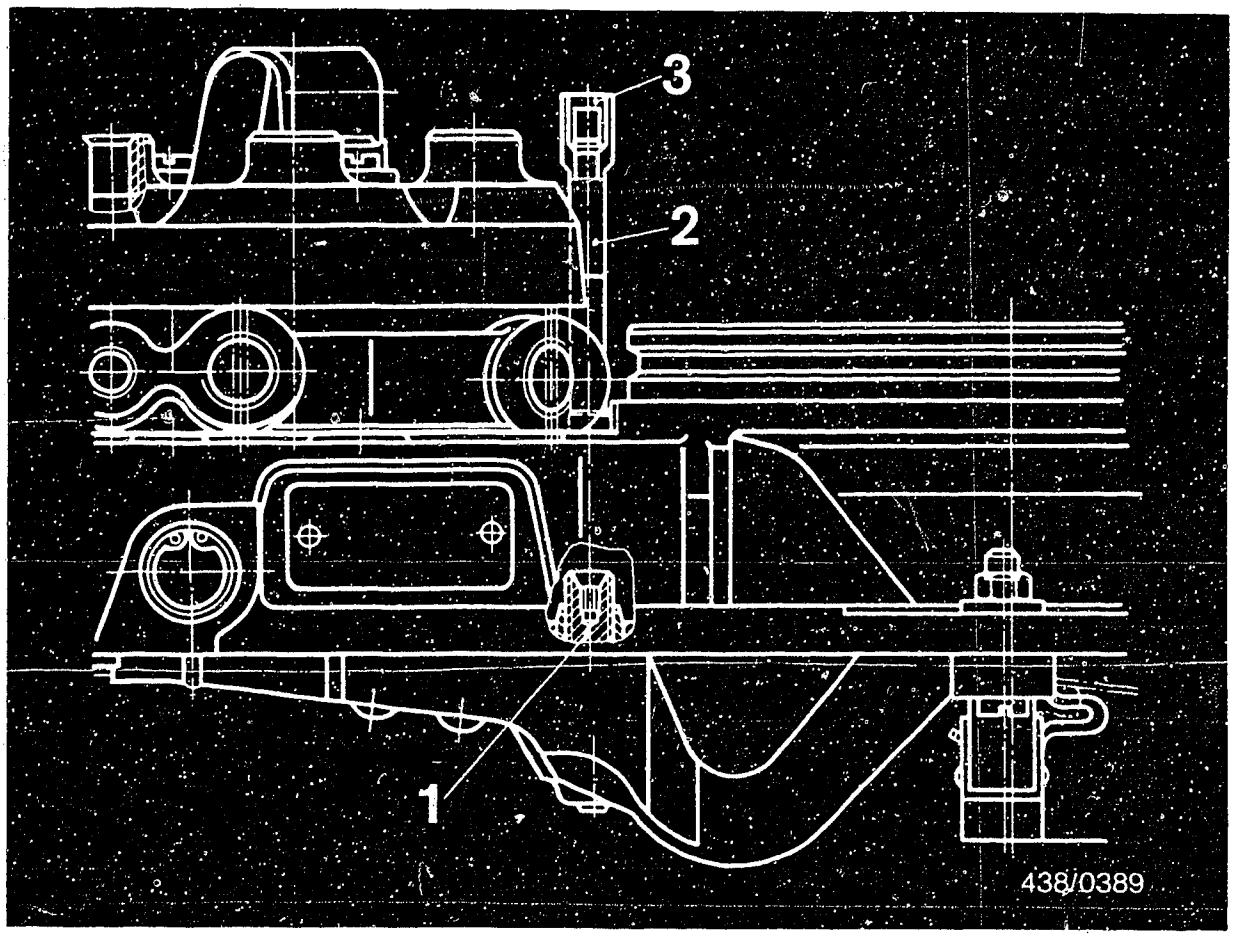


1 = Mixture-control screw
2 = Guide tube
3 = Lead seal

9.5 Matching the fuel distributor to the air-flow sensor for initial starting

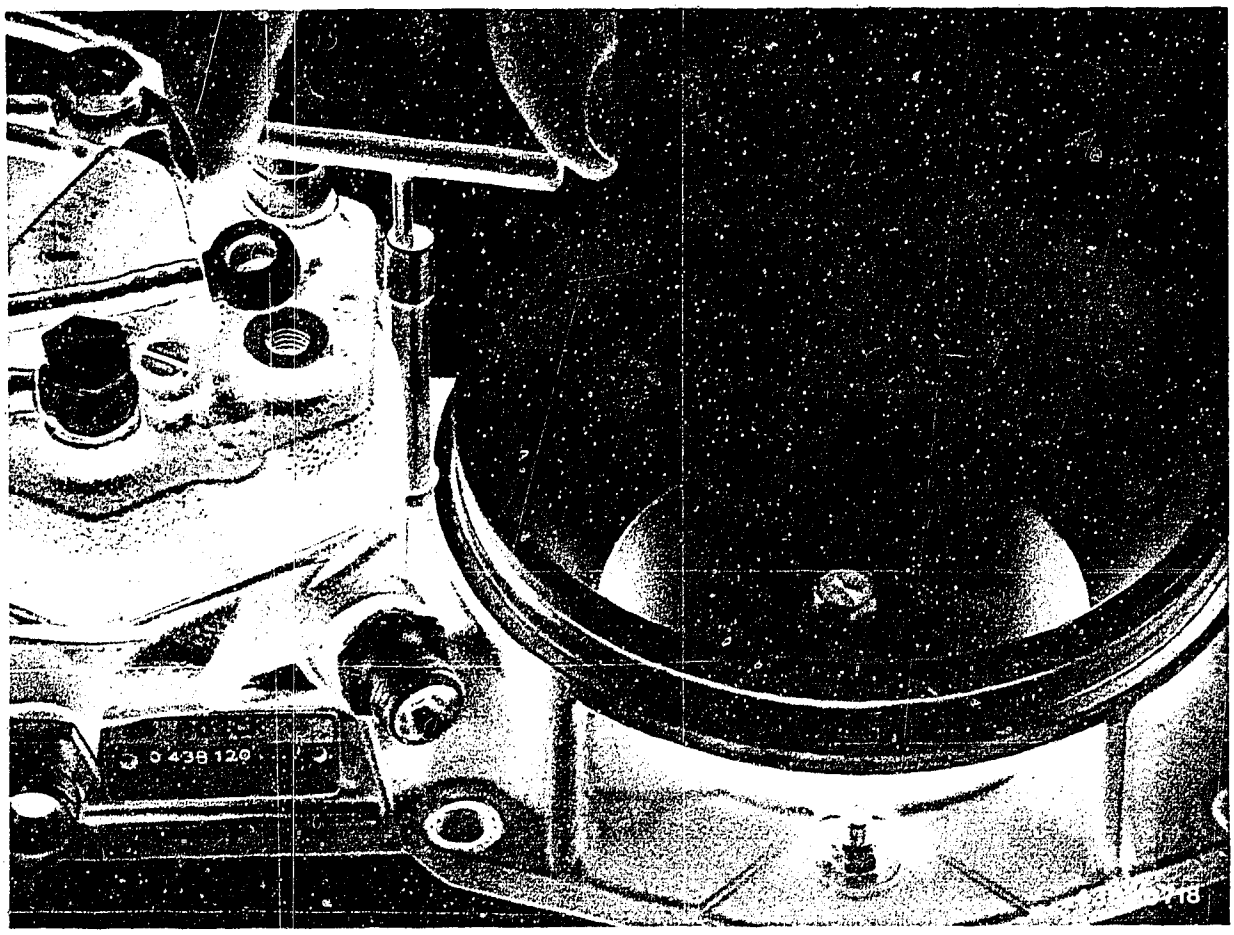
Screw off one fuel-injection line from the fuel distributor.
Bridge the electrical safety circuit so that the electric fuel pump operates.

The idle-mixture-adjusting screw is adjusted via a guide tube (2) rigidly fitted on the mixture-control unit.



1 = Idle-mixture-adjusting screw
2 = Guide tube
3 = Lead seal

Remove anti-tamper device (lead seal 3) of the idle-mixture-adjusting screw. Introduce adjusting wrench KDEP 1035 through the hole into the idle-mixture-adjusting screw.



Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the adjusting screw by 1/2 turn.

Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.

The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.

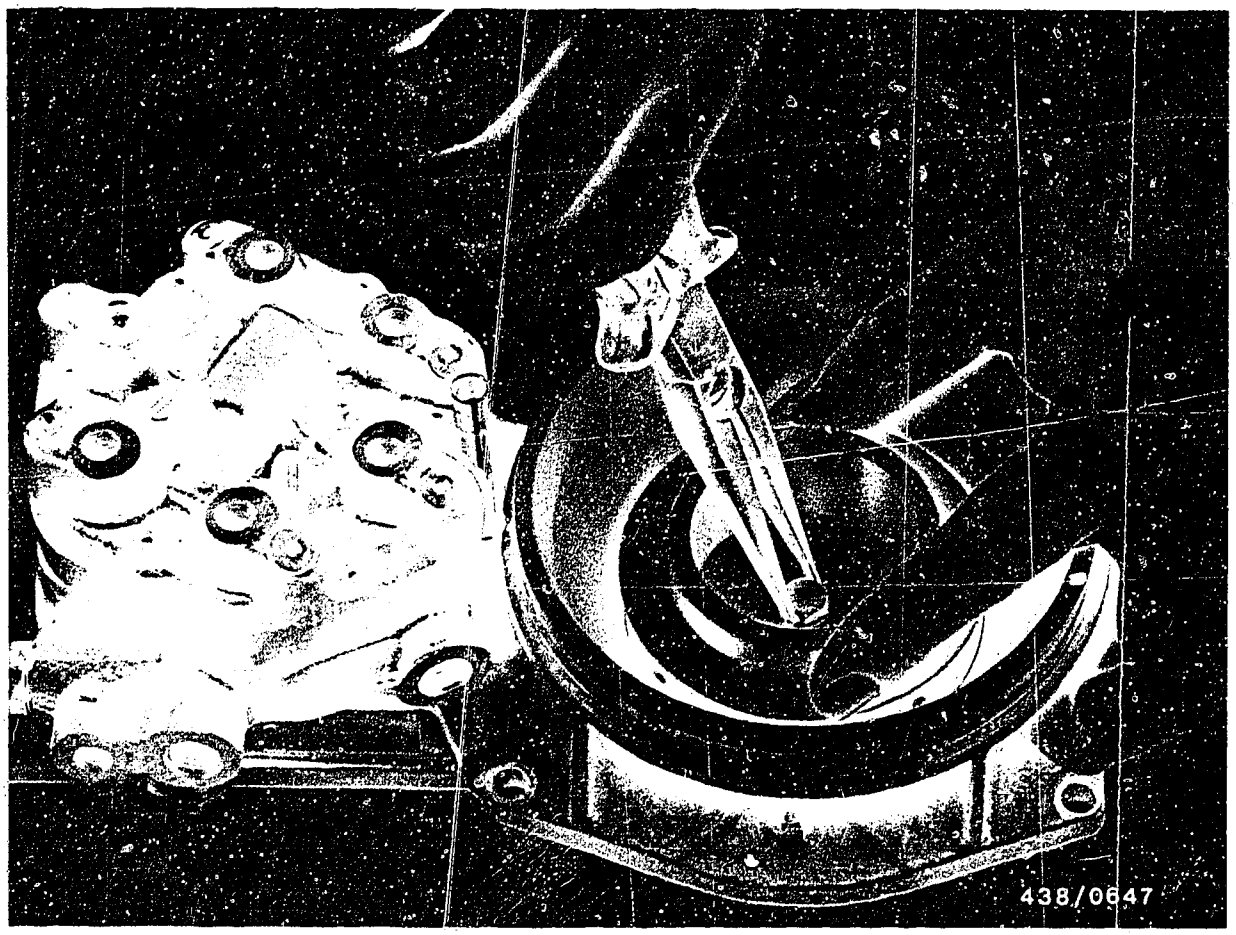
Idle-speed adjustment is described on Coordinates F 6.

10. Testing and adjusting the position of the air-flow sensor plate

10.1 Preparations

- Engine temperature is not important.

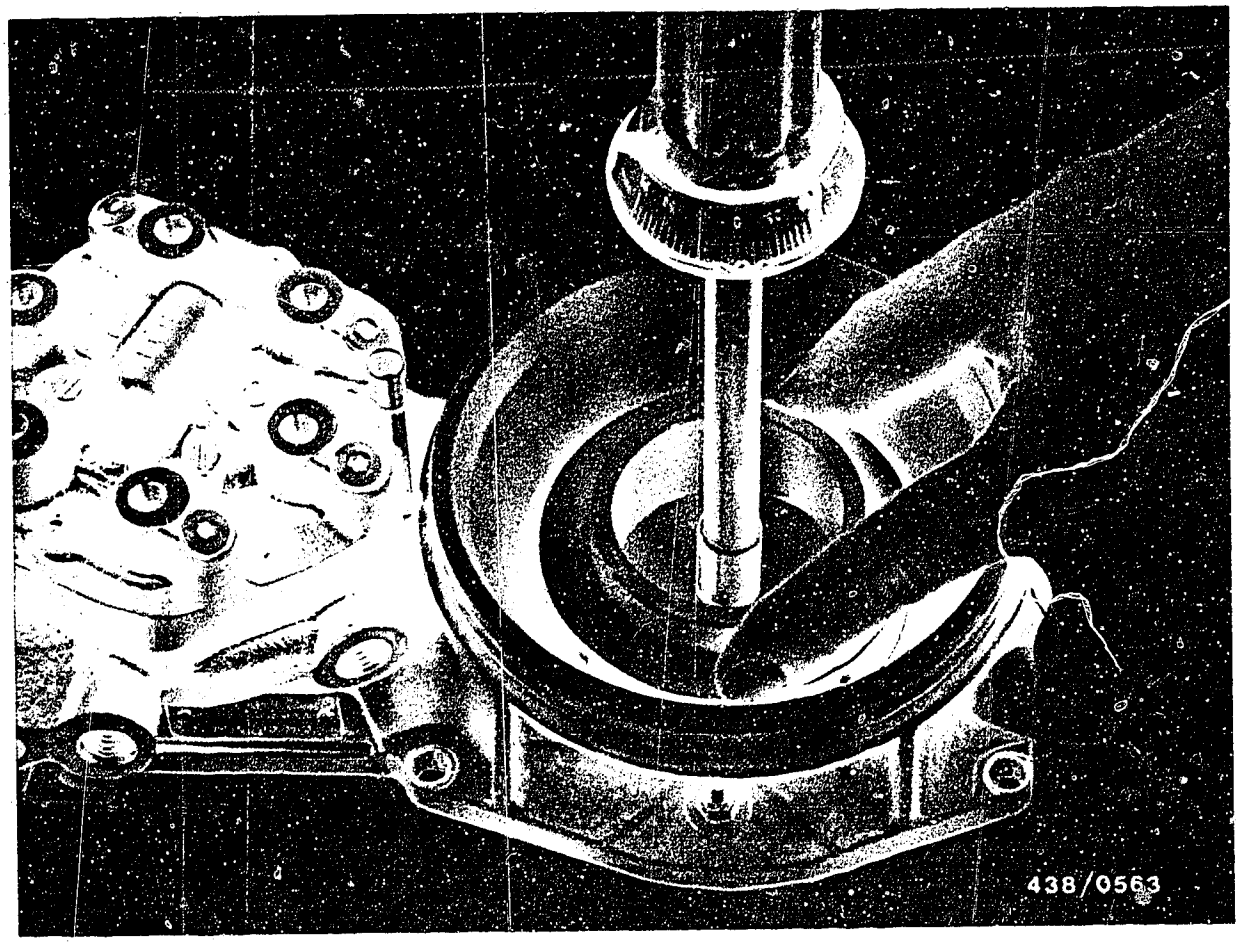
- Remove rubber dome from air-flow sensor (loosen clamping band) so that air-flow sensor plate becomes accessible.



10.2 Centering the air-flow sensor plate

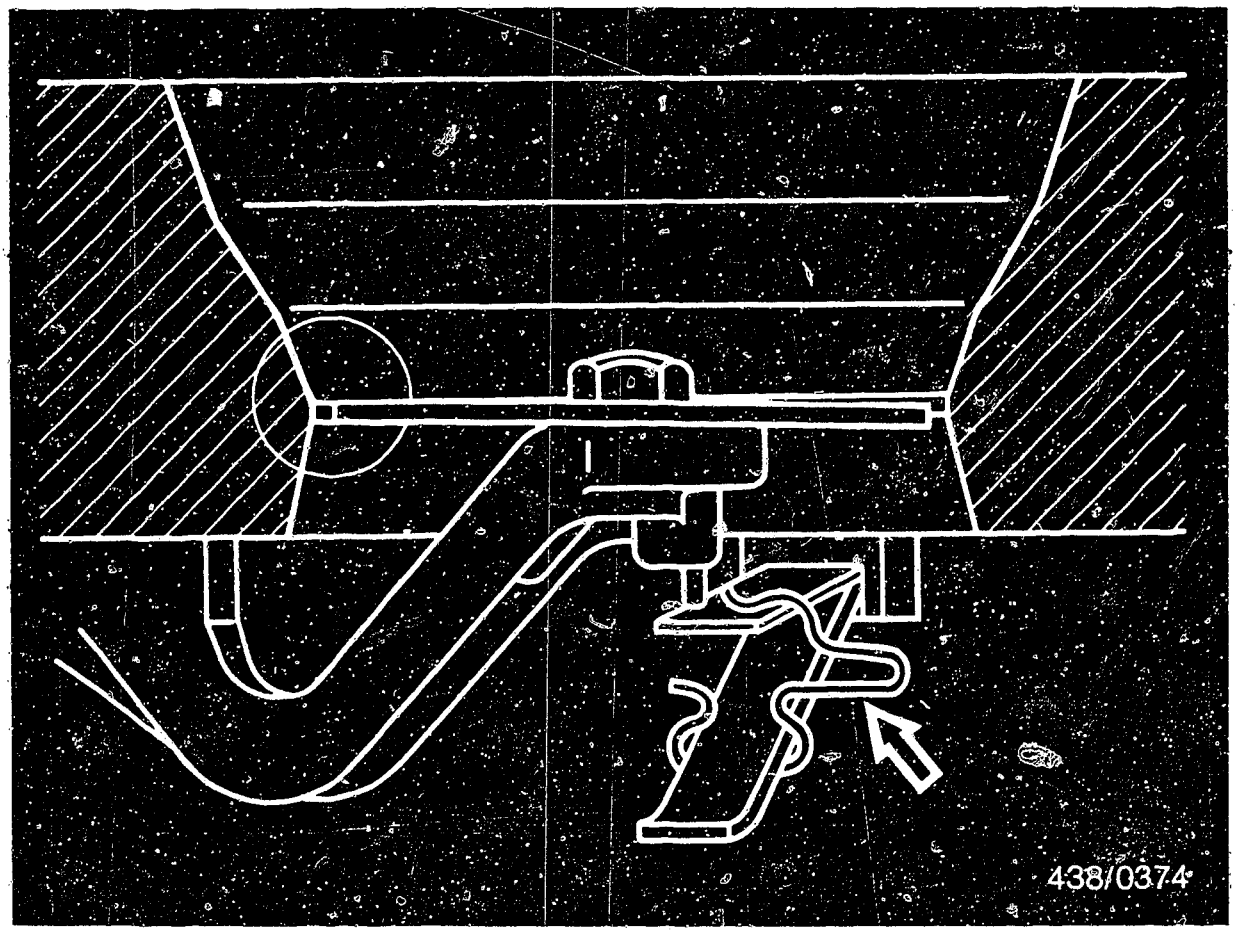
Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, center it using a positioning ring KDEP 1040/10 (dia. 80 mm) as follows:

Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screw with pliers so that the sensor plate does not deflect downwards.



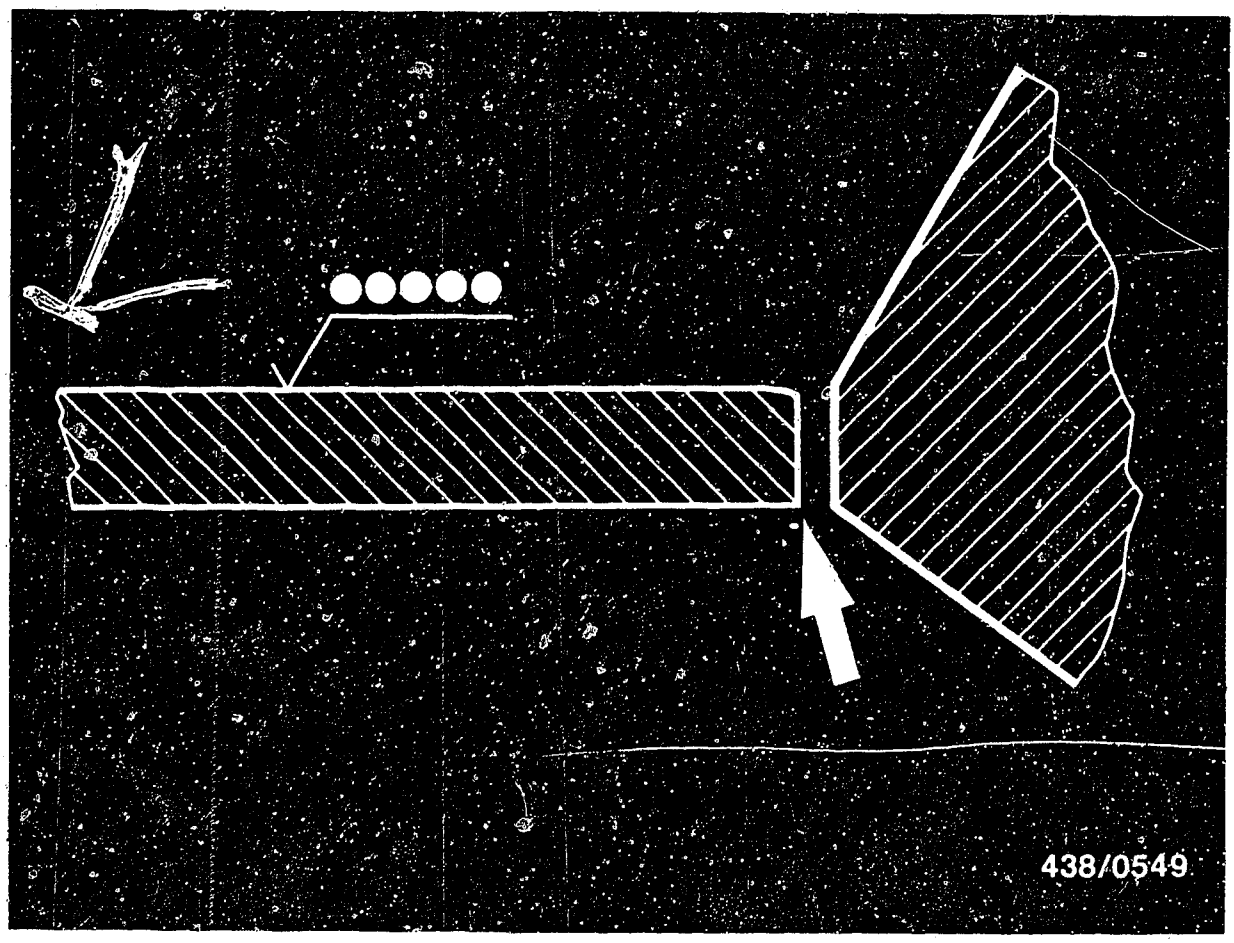
With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.
When tightening the screw make sure that the air-flow sensor plate is in its zero position (in the cylindrical part of the air funnel).
It must no longer be possible to turn the air-flow sensor plate by hand.

Caution:
The lower edge of the sensor plate is partially chamfered. In order to ensure that the sensor plate is correctly mounted, its upper side is identified either by the inscription "top" or by five punch marks in a row.



10.3 Checking and adjusting the zero position of the sensor plate (rest position):

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.
The top edge of the air-flow sensor plate must be flush with the start of the conical section at the point (circle) shown in the picture.
A lower position of up to maximum 0.5 mm is permissible, however the air-flow sensor plate must not project at any point on its circumference outside the cylindrical part of the air funnel.
If necessary, the position of the air-flow sensor plate can be adjusted by bending the shaped spring (arrow).



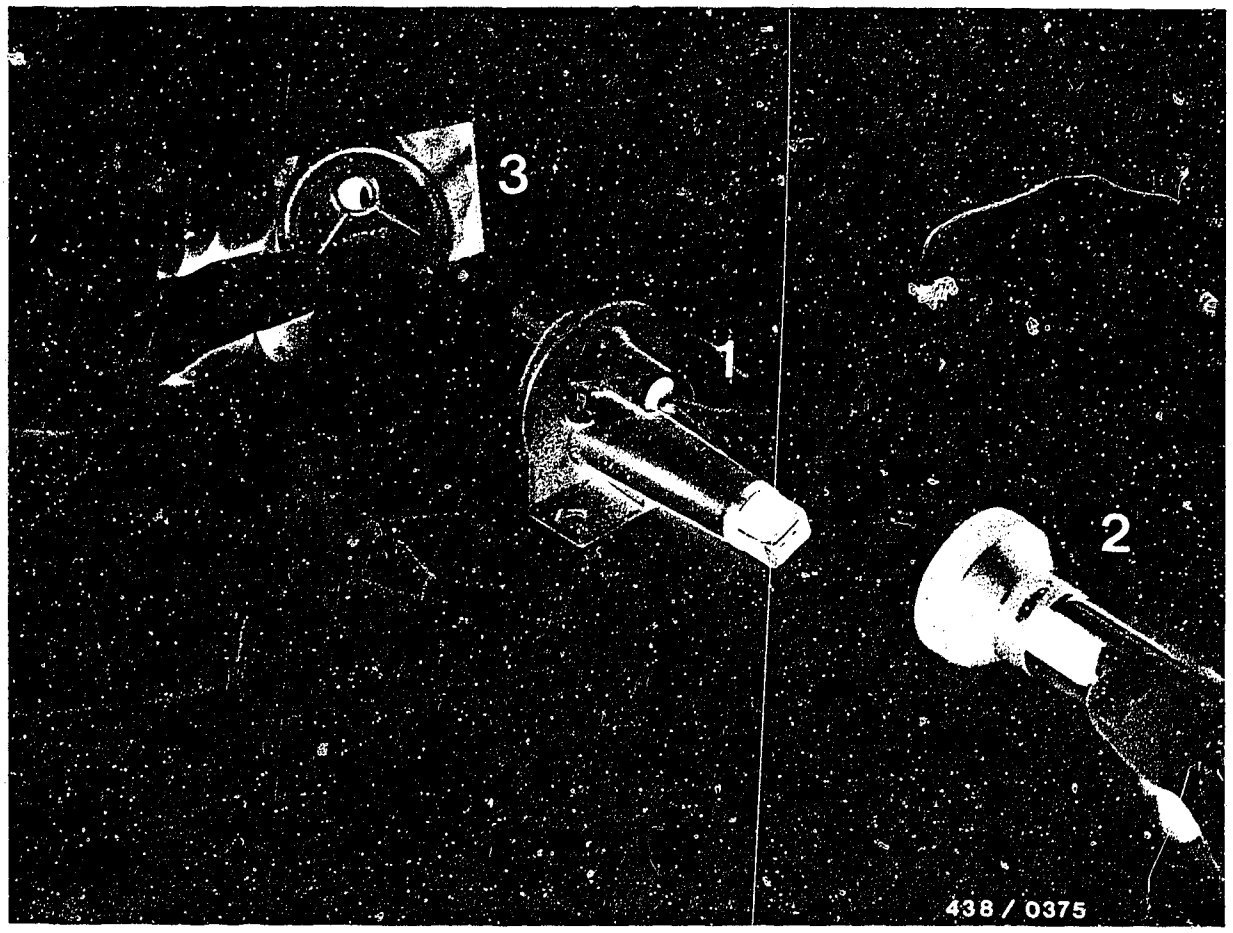
1 = Mark

Caution:

In some cases there is a chamfer (arrow) on the underside of the air-flow sensor plate.

Therefore, the top side is marked so that the air-flow sensor plate is correctly installed.

In some cases the marking is the word "top", and in some cases five centre-punch marks in a line.



1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

11. Checking the operation of the auxiliary-air device

The engine must be cold.
Remove plug from auxiliary-air device and warm-up regulator.
Disconnect both air hoses from the auxiliary-air device. Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open. It will be easier to look through the auxiliary-air device with the aid of a flashlight and a mirror, as shown in the illustration.

- If an opening is not visible with the engine cold, replace the auxiliary-air device.

- Fit the electric cable plug on the auxiliary-air device.

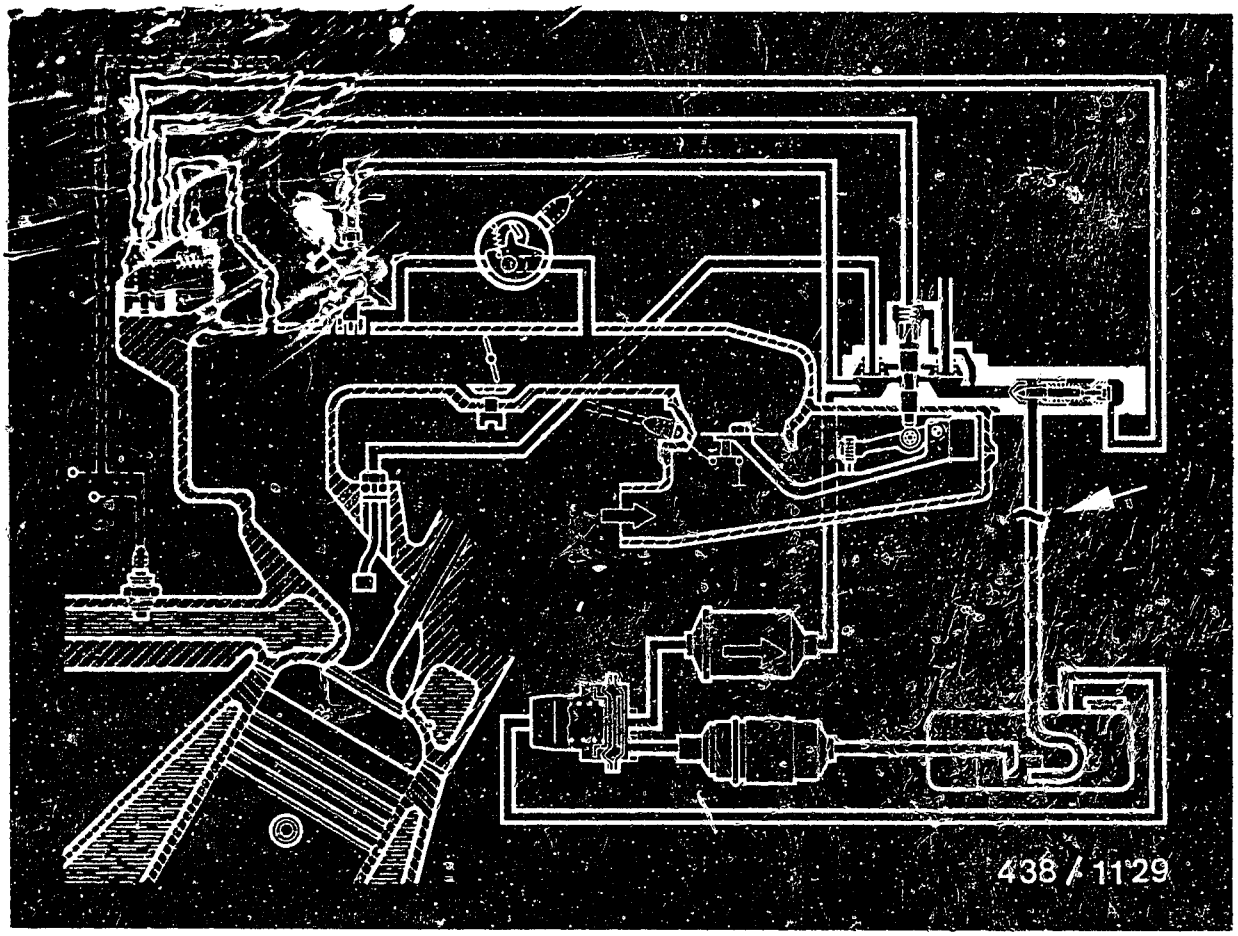
- By bridging the electrical safety circuit, supply power to the auxiliary-air device.
  After a maximum of 10 minutes, the opening in the auxiliary-air device must be completely closed by the blocking plate.

- If the blocking plate does not close, check the power supply (open circuit, voltage drop).
  Minimum voltage across the connector 11.5 V with the engine stopped.

- If these points are O.K., check the heating coil of the auxiliary-air device for an open circuit using an ohmmeter.

- Replace the auxiliary-air device if defective.

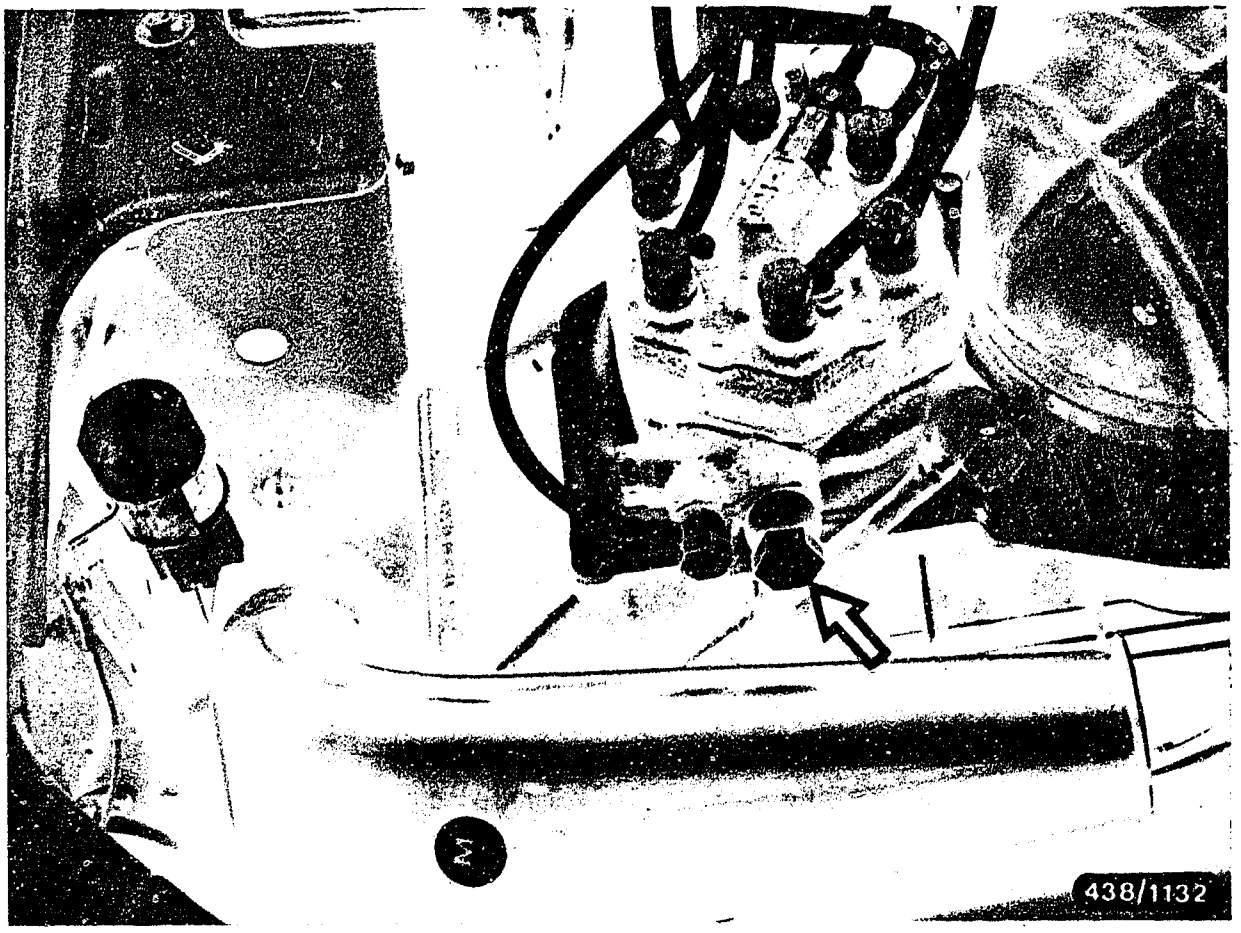
When the auxiliary-air device has been replaced, readjust the idle speed with the engine at normal operating temperature. Idle adjustment is described on Coordinates F 6.



12. Checking the operation of the electric fuel pump.

12.1 Requirement

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e. under primary (system) pressure. This measurement must therefore be made at the return line leading to the fuel tank (arrow).



12.2 Measuring point

A suitable measuring point for fuel-delivery testing is the return port (arrow) on the fuel distributor.
Unscrew the fuel return line from the fuel distributor. Equip a test hose with an inlet union (diameter 12 mm) and connect to the return port of the fuel distributor.

Hold the end of the hose in a graduate (approx. 1.5 litres capacity) in order to make the measurement.

12.3 Checking:

Pull off the plug from the warm-up regulator and auxiliary-air device. Switch on the electric fuel pump for 30 seconds by bridging the safety circuit and collect the fuel delivered in a graduate.

12.4 Test specification:

Fuel delivery: at least 930 cm^3/30 seconds.

12.5 Possible causes of insufficient fuel delivery:

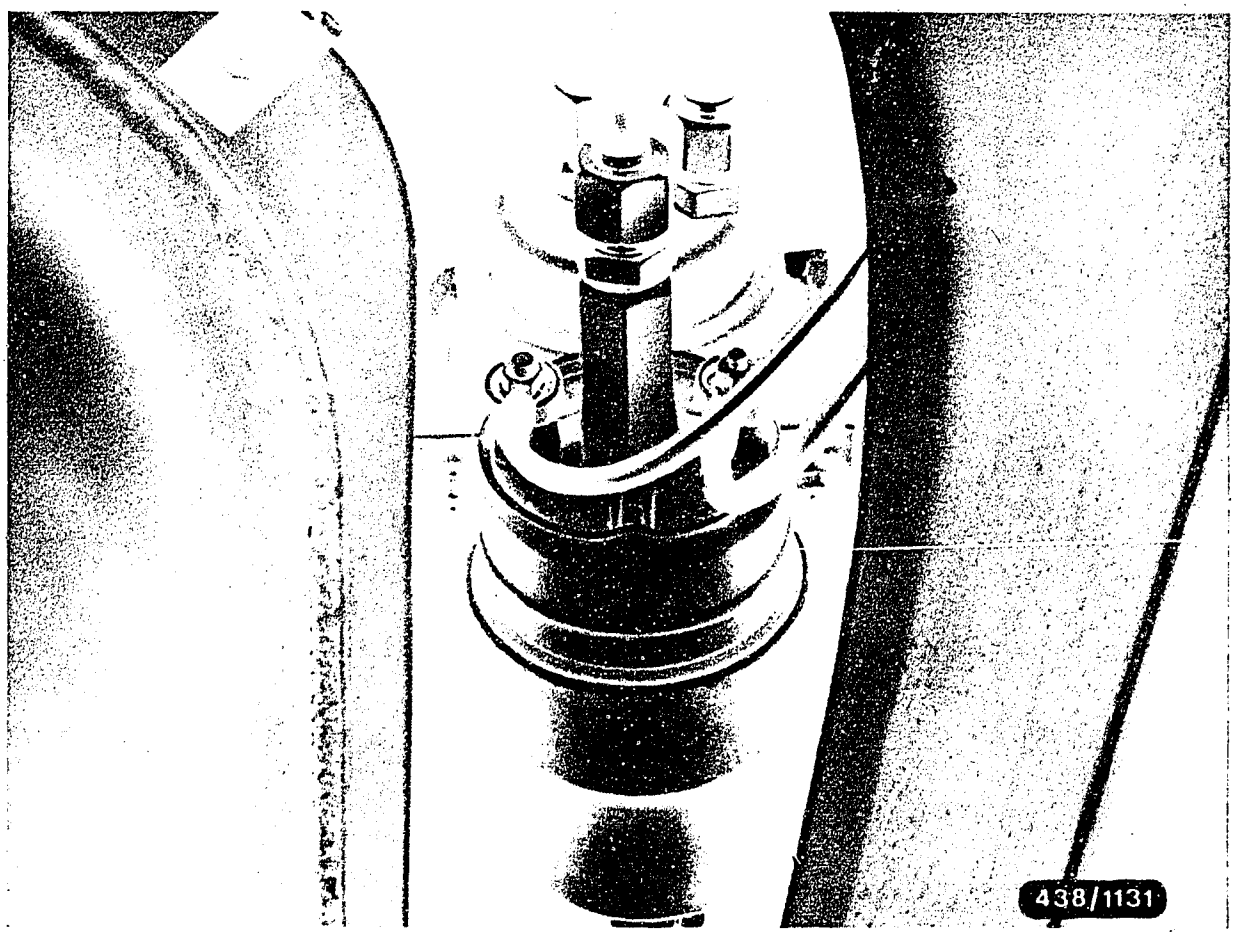
- Power supply to the electric fuel pump defective, voltage drop. Minimum voltage at terminal with pump operating = 11.5 V.
- Fuel filter very dirty.

If these points are O.K., the fault lies in the electric fuel pump itself.
Replace the electric fuel pump.

12.6 Removal and installation of the electric fuel pump:

Pinch off the fuel intake hose from the fuel tank to the electric fuel pump (e.g. using hose clamper W 157 from Matra Co.).

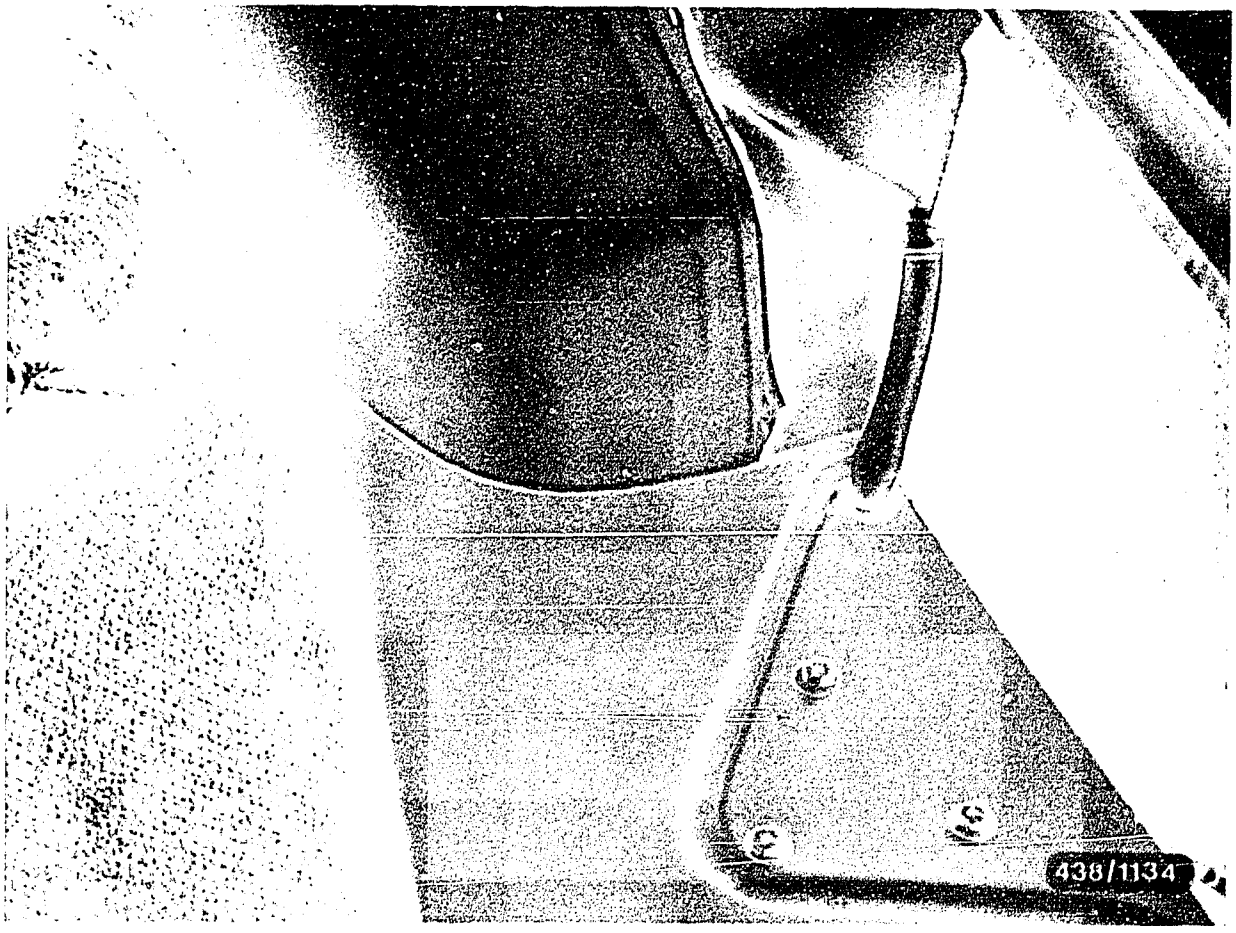
When installing, use a new seal and pay attention to the correct positioning of the electric fuel pump. Danger of bending the fuel lines.



12.6 Removing and installing the electric fuel pump

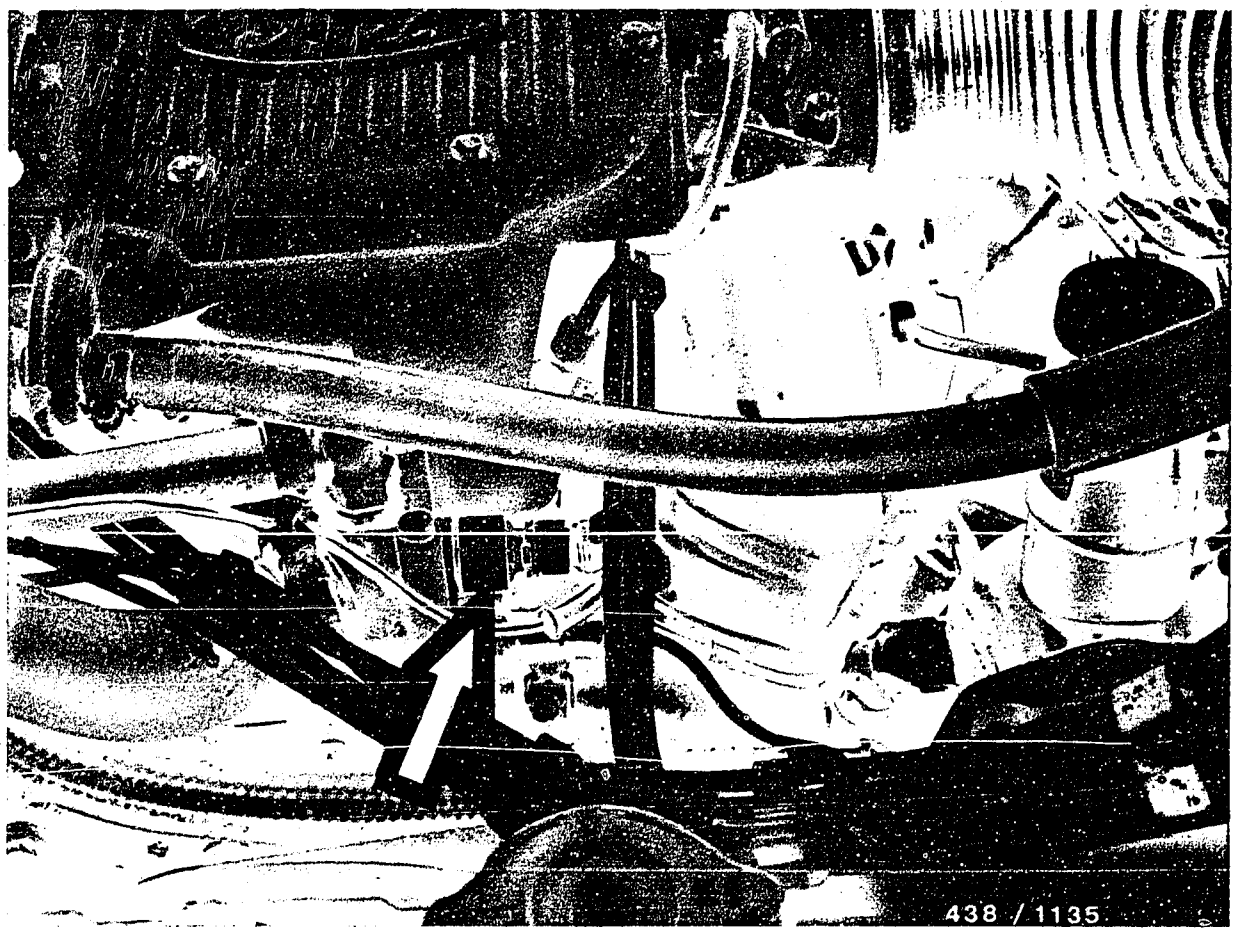
On underside of vehicle, on right-hand side as viewed in forward direction of travel, next to fuel tank. Remove dirt-deflector plate so that the bracket for electric fuel pump and fuel accumulator becomes accessible.

Pinch off intake hose (e.g. using hose clamper W 157 from Matra Co.).
Remove intake hose, delivery line and electrical connections, catching any escaping fuel.



To replace the electric fuel pump, loosen the entire bracket and swing downward.

The three fastening screws of the bracket are accessible from the right-hand side of the luggage compartment after removing the mat (see picture).

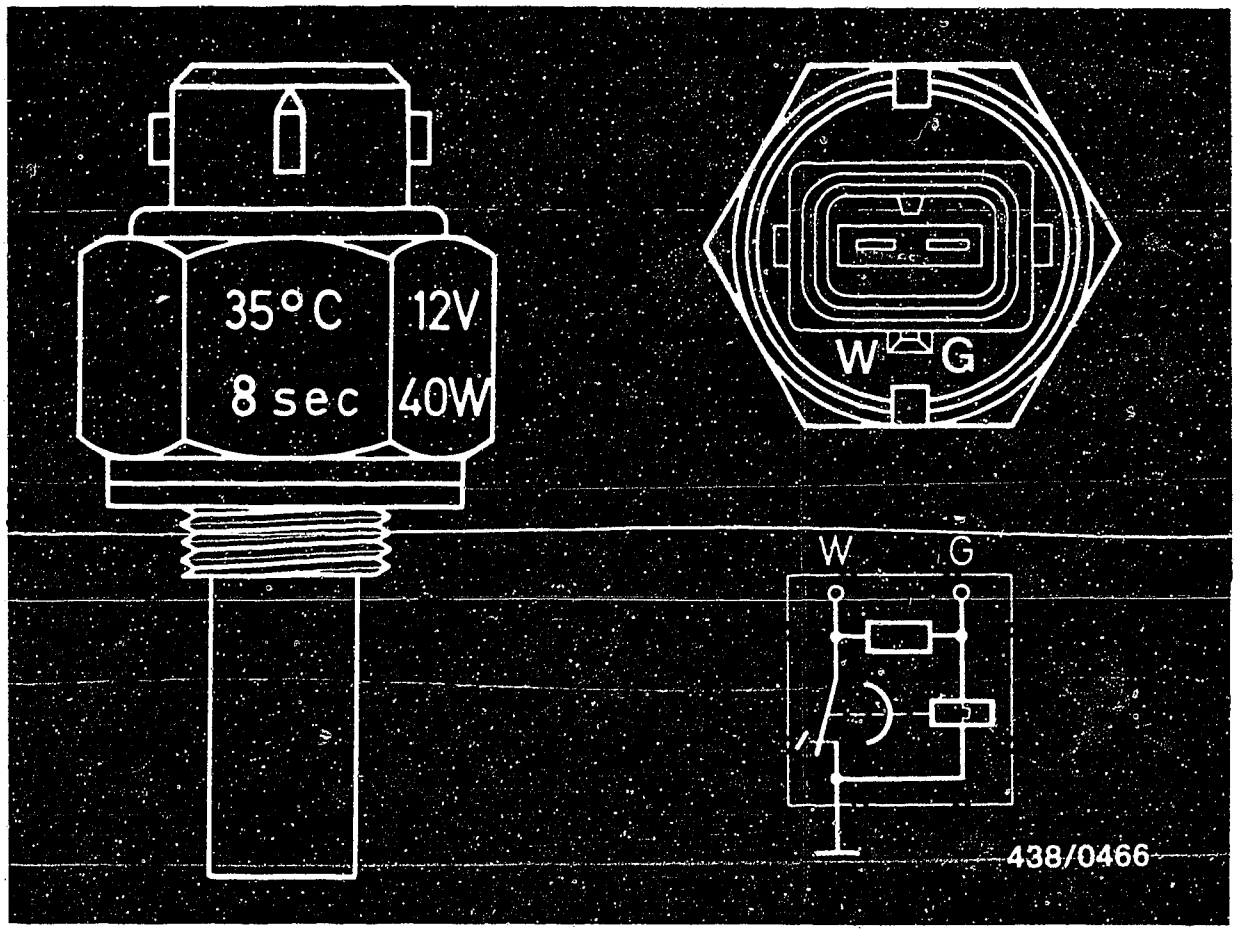


13. Testing the cold-starting system (thermo-time switch, start valve)

13.1 Thermo-time switch

Remove thermo-time switch for testing.
It is screwed into the coolant fitting on the front side of the engine (see picture, arrow).

Caution:
If possible, remove only when the engine is cold since a small amount of coolant will escape. The amount of coolant escaping would be considerably greater if the engine were hot.



The switching temperature +35°C and the switching time at -20°C of 8 seconds are stamped into the hexagonal section of the thermo-time switch.
The removed thermo-time switch is tested using the ohm-meter in accordance with the specificaions given below. The temperatures for the thermo-time switch can easily be obtained with water. Cooling takes place in a freezer chest.

At a temperature below °C	above °C	Resistance measurement (Ω) between Term. "G" and "ground" (housing)	Term. "W" and "ground" (housing)	Term. "G" and Term. "W"
+30		25...40	0	25...40
	+40	50...80	100...160	50...80

Special information for vehicles up to January 1977 month of production

Wiring harness for thermo-time switch

In the above-mentioned vehicles, terminals G and W were swapped in the plug housing to the thermo-time switch when the wiring harness was produced.

This means that during cold-starting there is a direct connection between terminal 50 and ground through the switching contact of the thermo-time switch.
After several starts this leads to the destruction of the thermo-time switch.

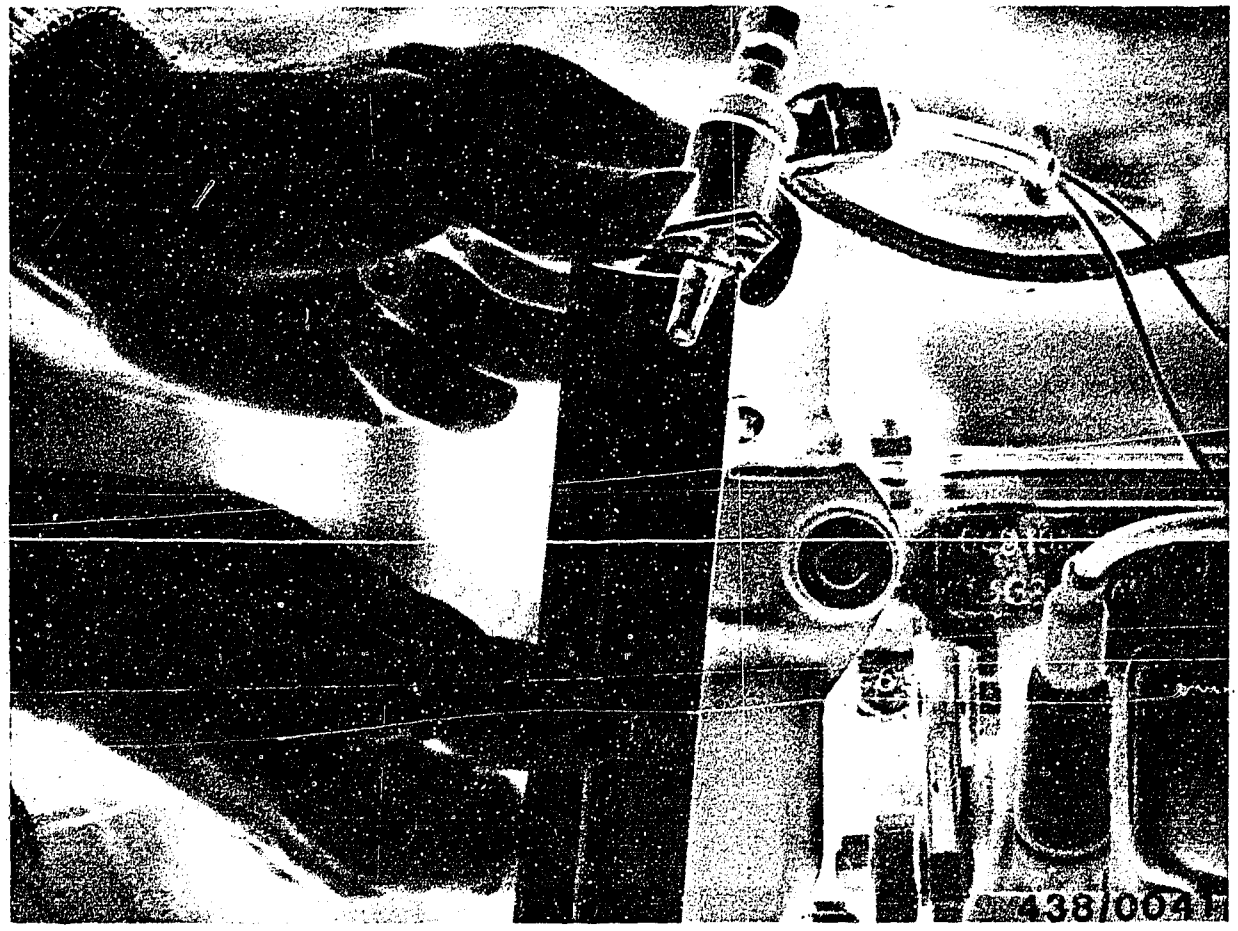
If there are cold-starting problems on these vehicles, check whether the pin assignment has been rectified:

Remove plug from thermo-time switch and from start valve.
When starting (+ to terminal 50) test from terminal W/G of wiring-harness plug to ground using test lamp.
If the test lamp lights up, this is the lead 50 for terminal G.
If necessary, swap contacts in plug and replace thermo-time switch.

Connect plug to thermo-time switch and to start valve.

Thermo-time switch part number: 0 280 130 214.

Vehicles in which the lead to the thermo-time switch bears a red band have already been converted at the factory.



13.2 Start valve:

Remove the start valve. Hose line remains connected. Pull off the plug and connect the start valve directly to ground and to terminal 15 (e.g. at the ignition coil) using connecting cable KDJE 7450/70.

Important note:
During this test, do not let the connecting cable touch B +. Danger of fire due to sparking!
Hold the start valve in a suitable container (e.g. the graduate).

Switch on the electric fuel pump by bridging the safety circuit.
Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.
The safety circuit remains bridged so that the primary pressure is applied to the start valve.
No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.
Then switch the electric fuel pump off again.
Replace the start valve if it does not open or if it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 6.

14. Checking the control pressures

14.1 Preliminary remarks:

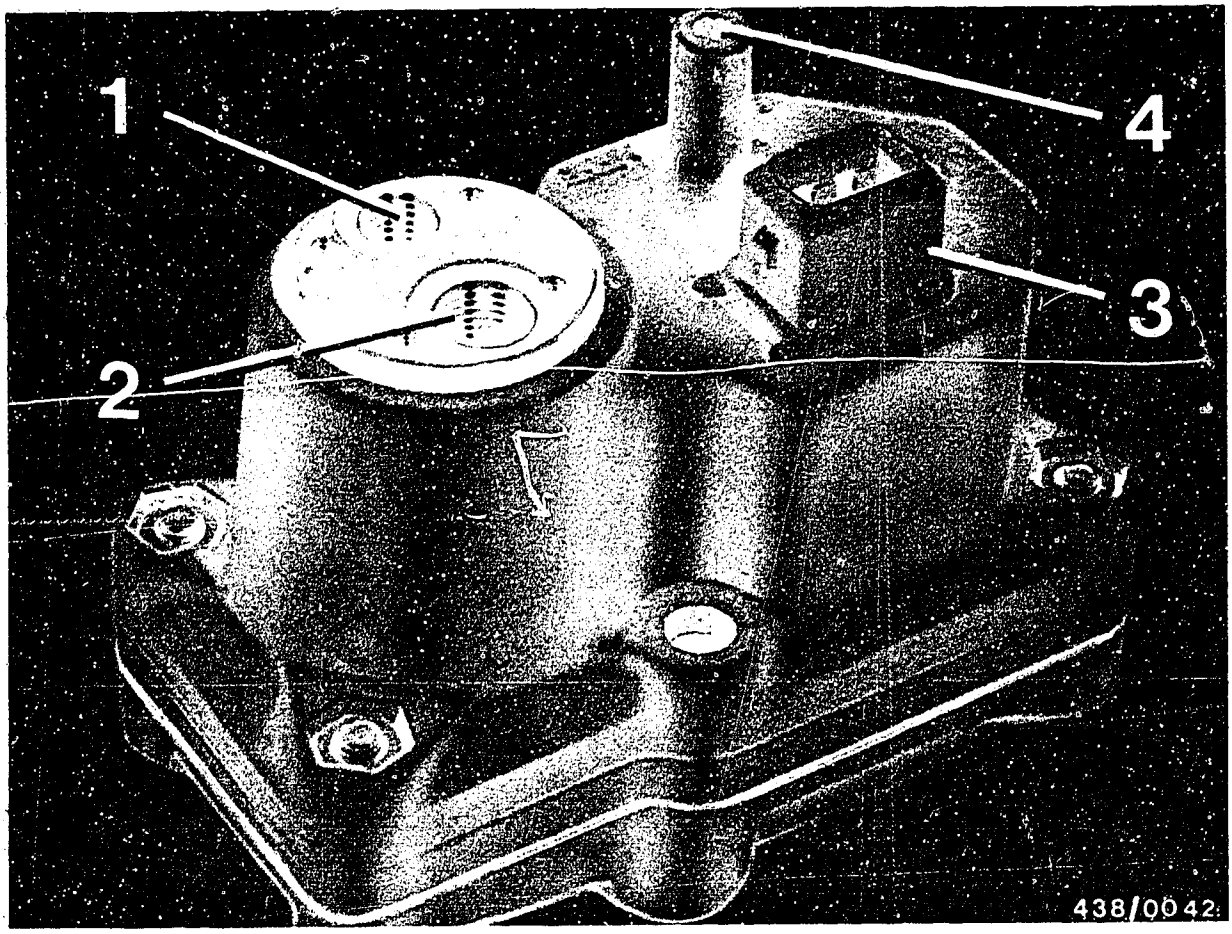
The control pressures tested in the following are in each case governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

- No or too low a voltage at the electric connector.
- Fuel return from the warm-up regulator blocked or constricted.
- Too high a fuel delivery for the control-pressure circuit.

The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests.
Test specification: 160...240 cm^3/min.

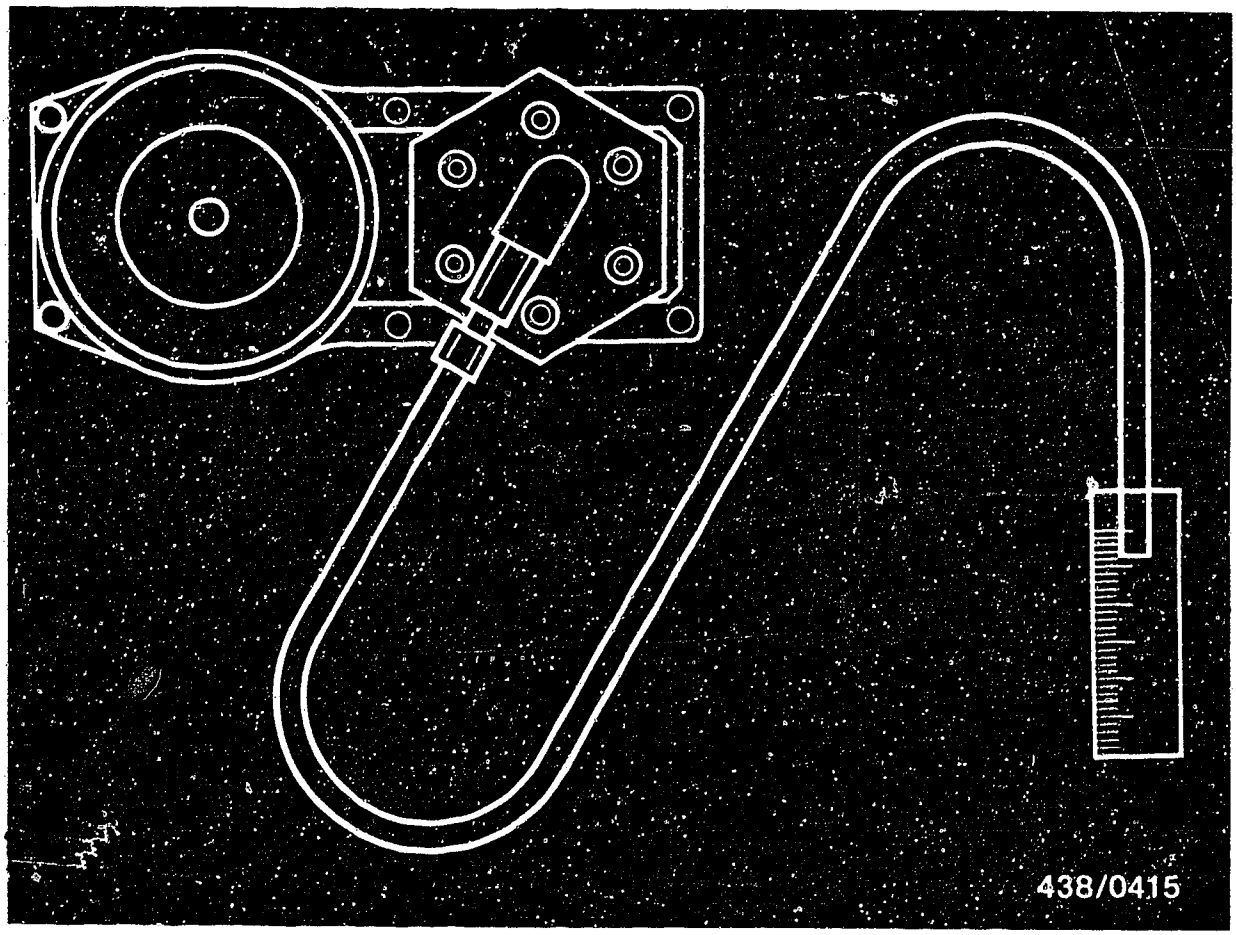
Reference is made to the other possible causes of trouble in the respective test step.



1 = Return port (M 8 x 1)
2 = Inlet port (M 10 x 1)
3 = Electric terminal
4 = Intake-manifold-pressure connection port (after throttle valve)

14.2 Version of warm-up regulator

The warm-up regulator is a version for intake-manifold-pressure-controlled full-load enrichment. This means that the cold and warm control pressures are additionally influenced by the intake-manifold pressure acting on the full-load diaphragm of the warm-up regulator. The intake-manifold pressure connection port (4) is located on the top of the housing cover. In the base plate there is an opening for atmospheric pressure.



14.3 Checking the fuel delivery for the control-pressure circuit:

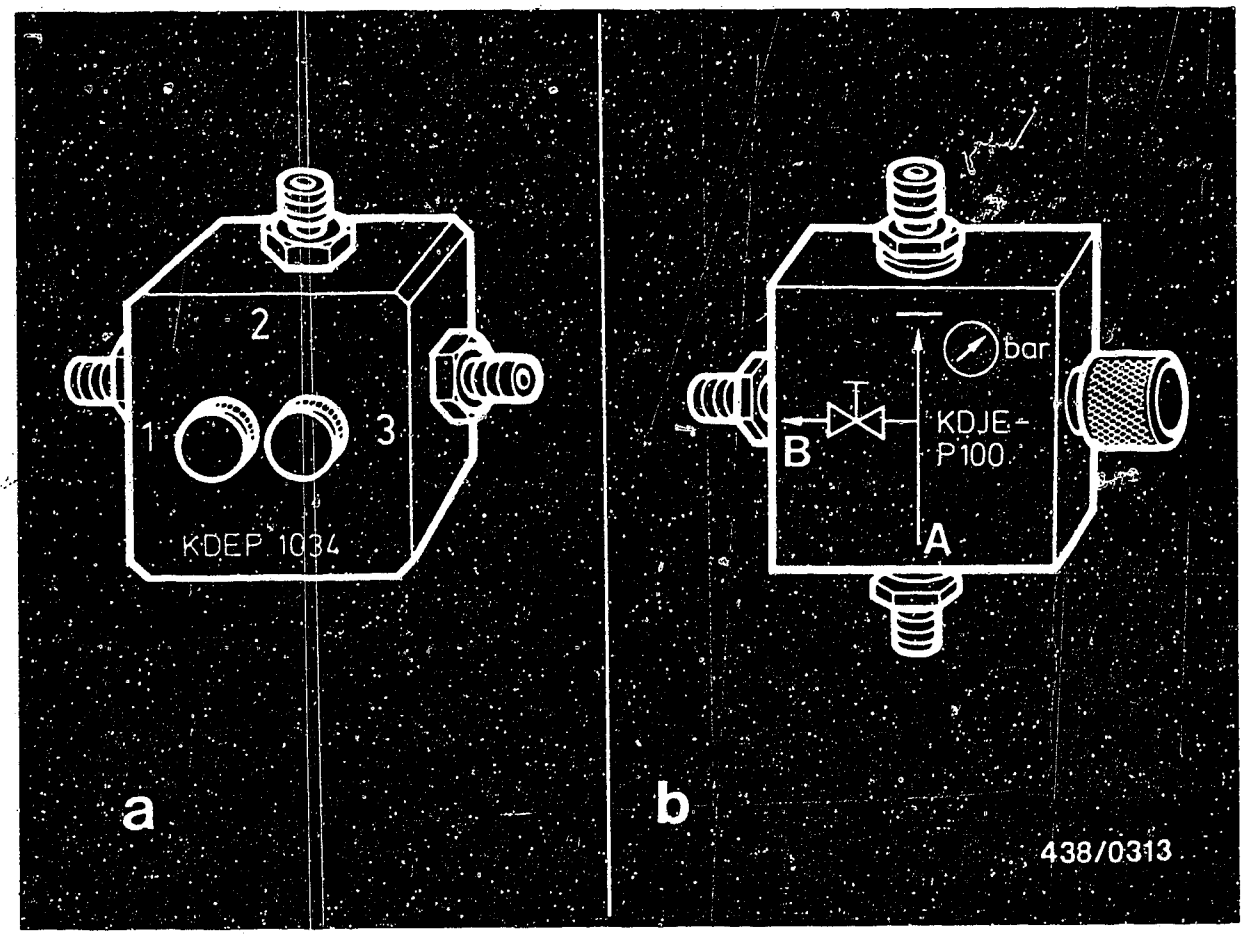
Before testing, make sure that the electric fuel pump is operating properly.
Test specification: min. 930 cm^3/30 s.

Unscrew control-pressure line (to warm-up regulator) on fuel distributor and connect one of the two hose lines of pressure tester KDJE-P 100 (previously KDEP 1034) to the control-pressure connection port on the fuel distributor (thread M 12 x 1.5) and hold in a graduate (approx. 0.5 l capacity).

Switch on the electric fuel pump for 1 minute by bridging the safety circuit.
Measure delivery.

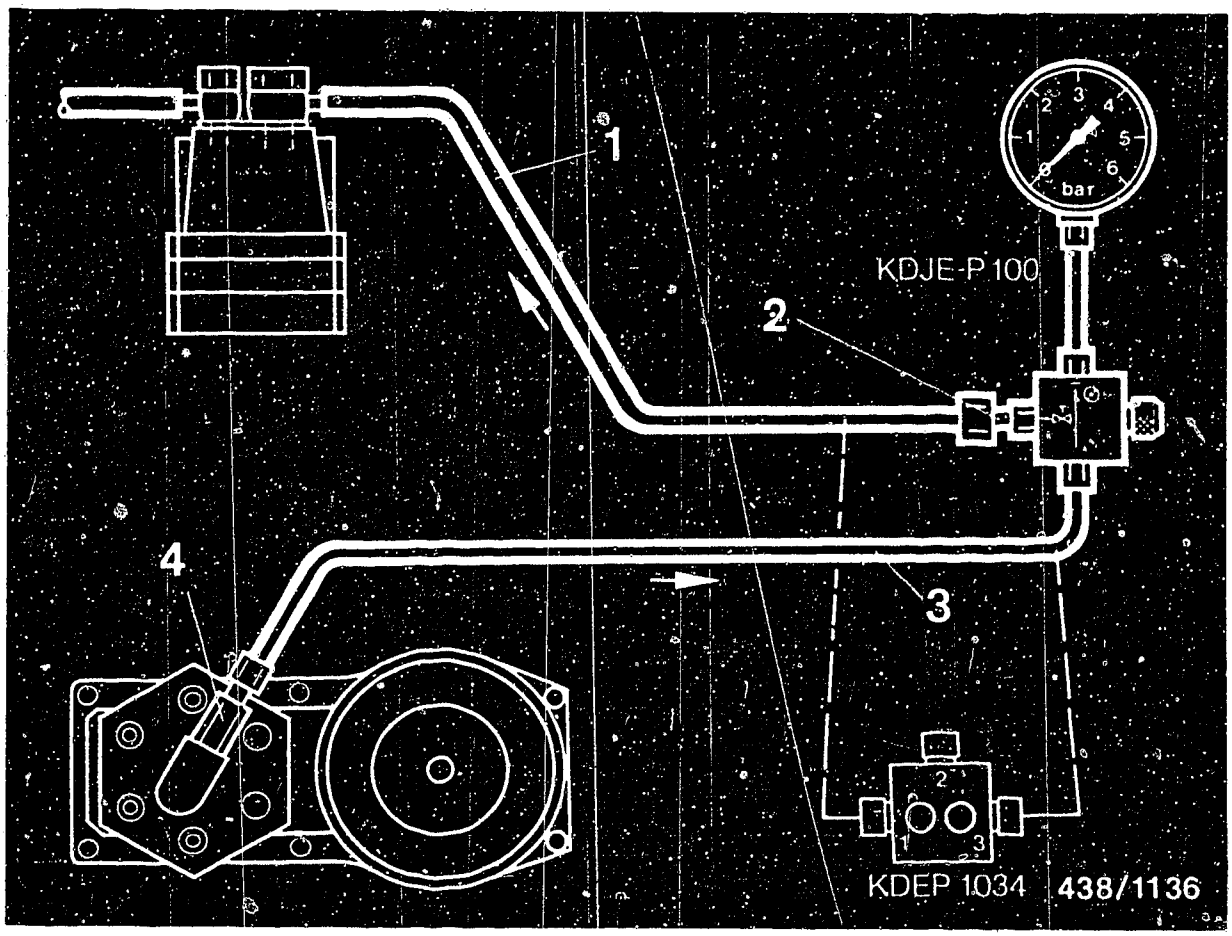
Test specification: 160...240 cm^3/min.

If the measured value is outside tolerance, the fault is in the fuel distributor.
Replace the fuel distributor.



14.4 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)
Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

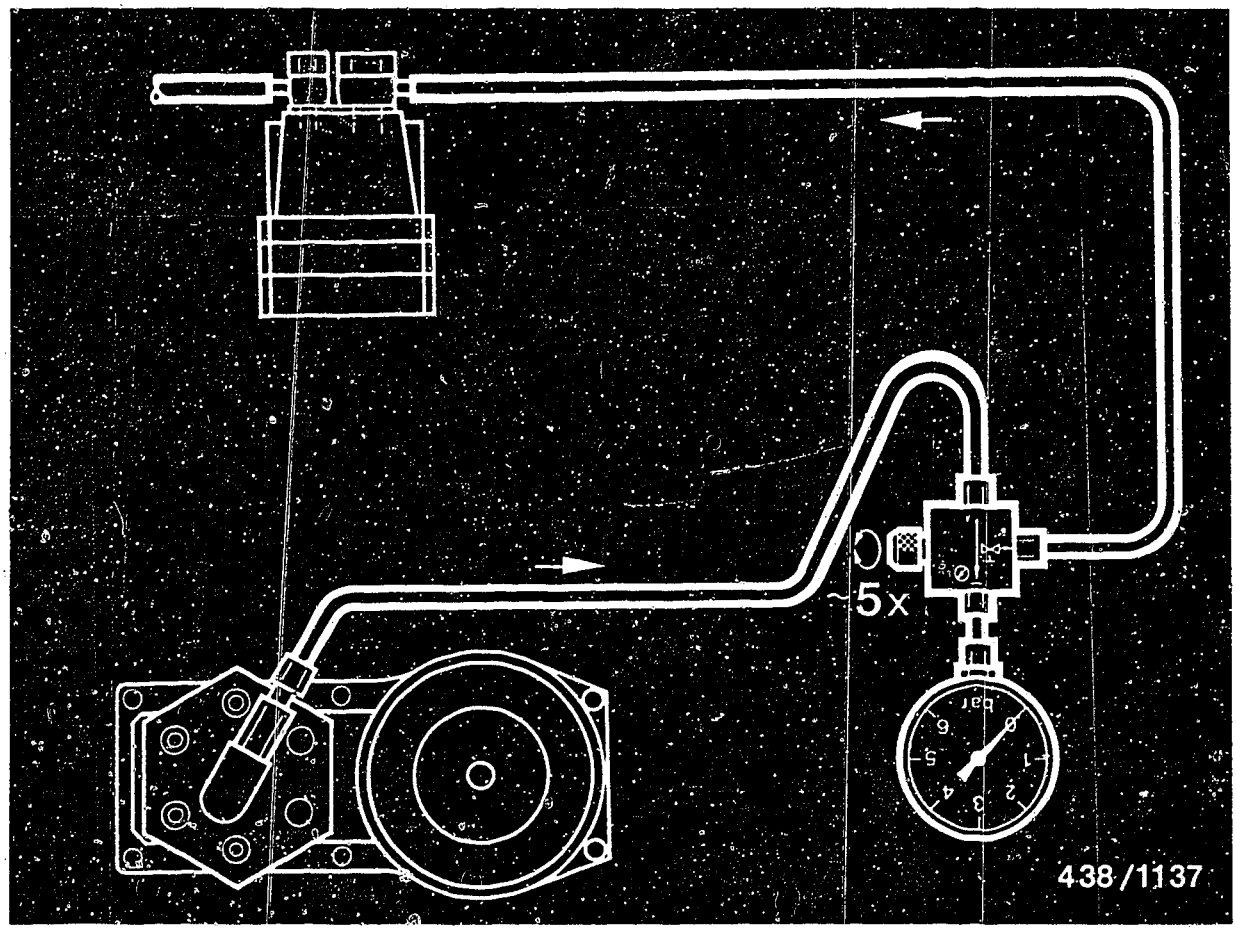


The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew control-pressure line (1) from fuel distributor and connect to outlet fitting B or 1 (2) of directional-control valve.

Connect hose line (3) of pressure tester to control-pressure connection port (4) of fuel distributor.

Suspend pressure gauge from hood (possibly using a wire hook).



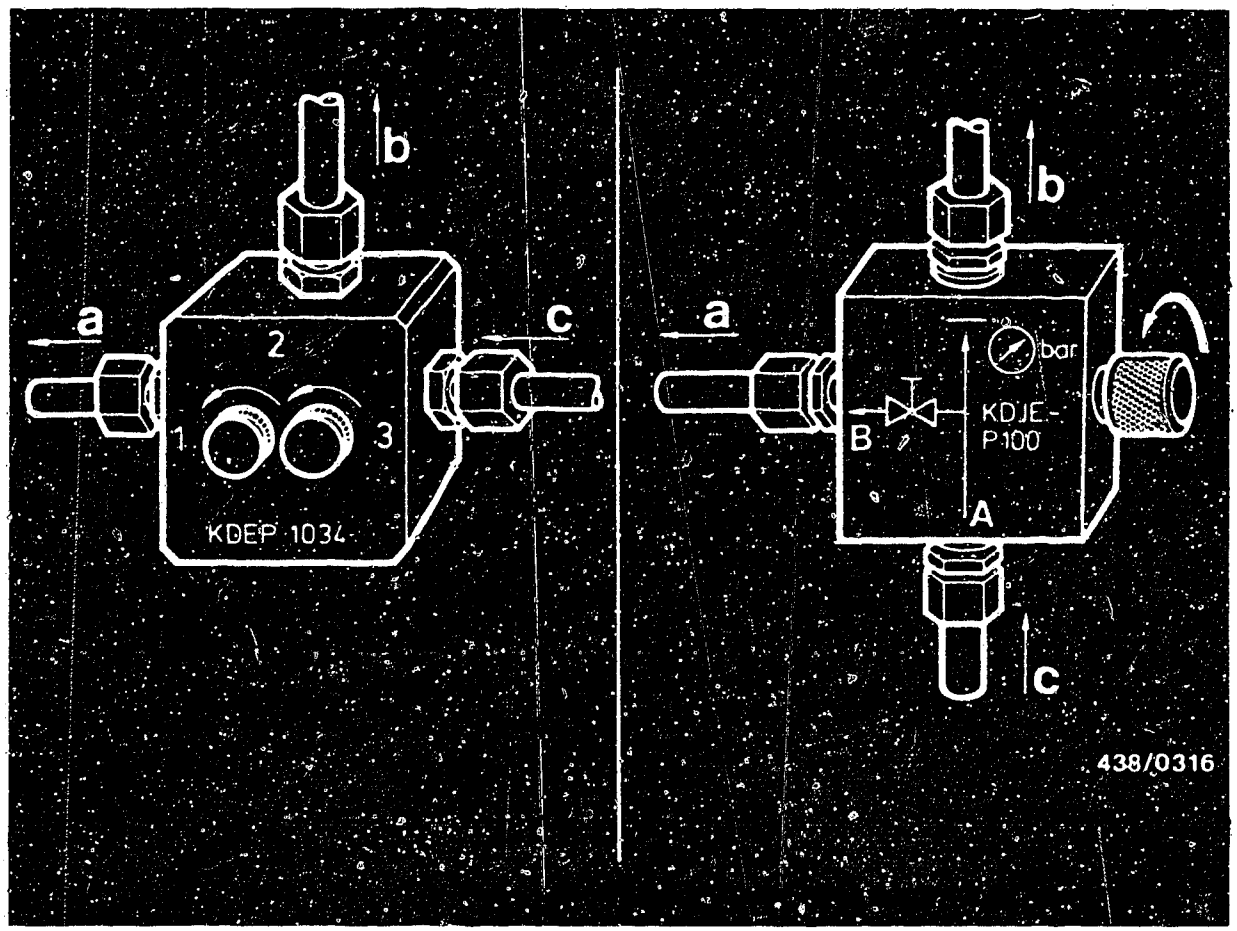
14.5 Bleeding the pressure tester

Remove electrical connector from warm-up regulator and auxiliary-air device.

Allow pressure gauge to hang down (extended hose line). Switch on electric fuel pump by bridging the electrical safety circuit.

Open and close hollow screw of directional-control valve (hollow screw 1 on KDEP 1034) approx 5 times in a 10-second rhythm.
Then re-attach pressure gauge to a suitable point (e.g. strut on hood).

Open hollow screw of directional-control valve (both screws in the case of KDEP 1034) (turn in a counter-clockwise direction).

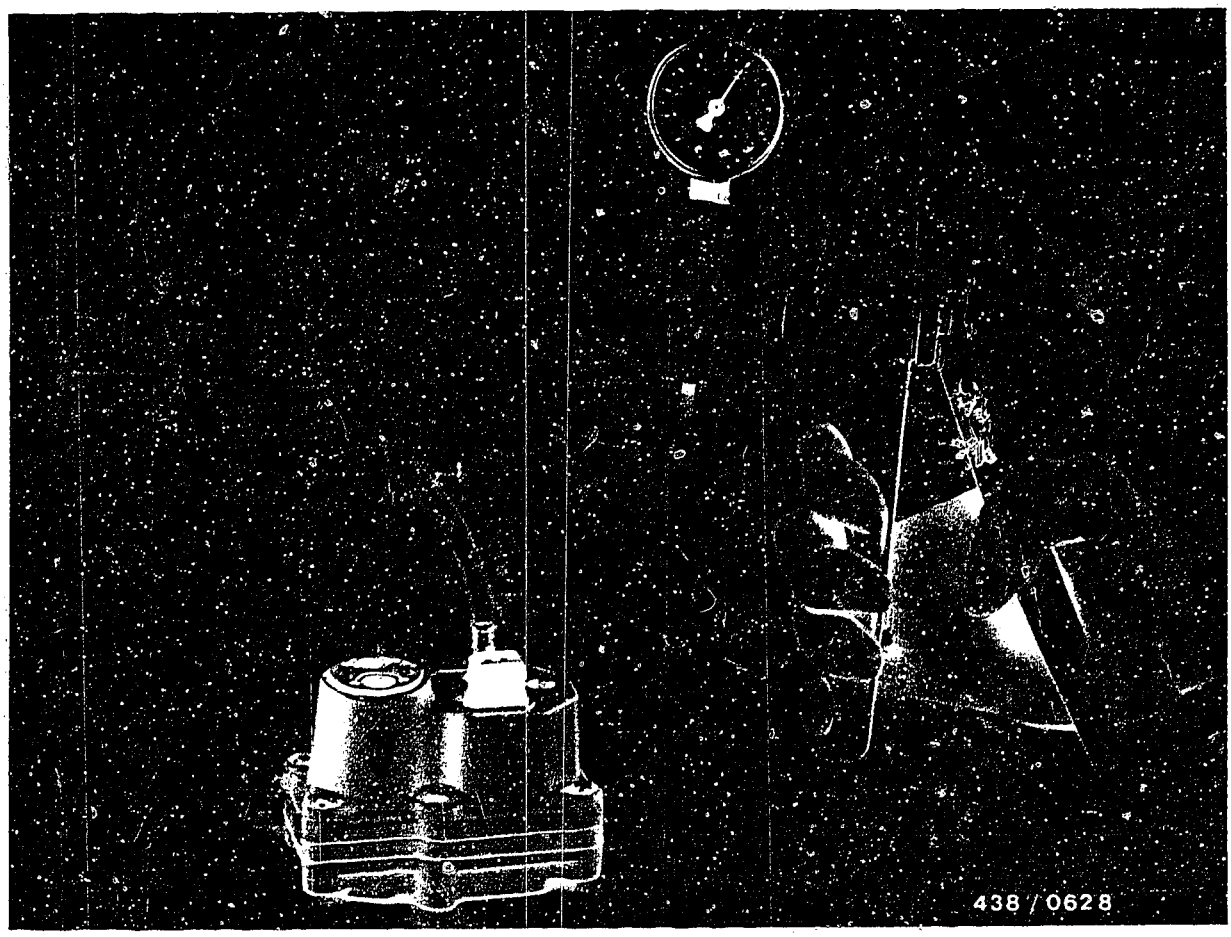


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.6 Testing the "cold" control pressure:

Warm-up regulator: 0 438 140 038

The test is performed with the engine switched off.
The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.
Pull off the plug from the warm-up regulator.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
Switch on the electric fuel pump by bridging the electrical safety circuit.

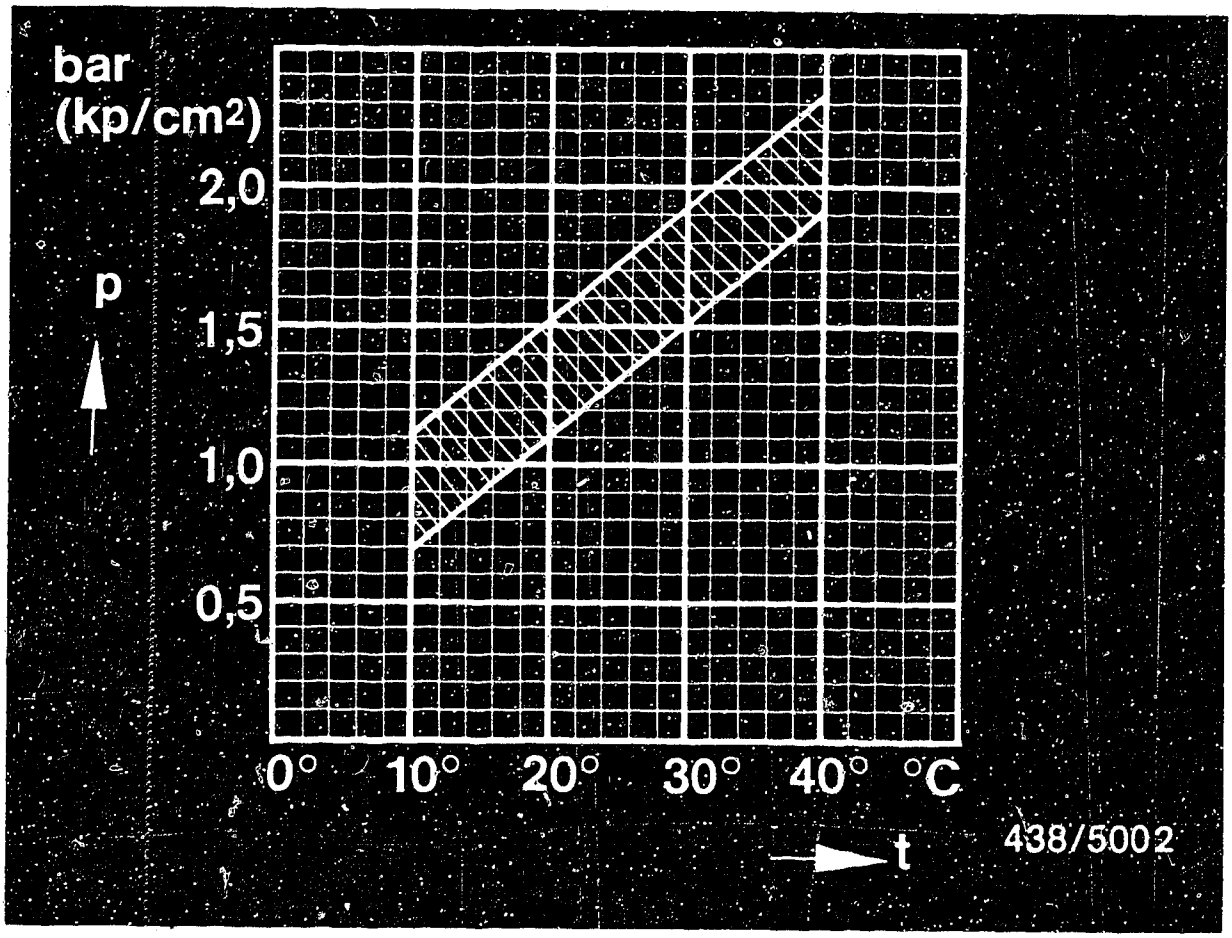


The control pressure is tested with simulated intake-manifold pressure, i.e. by applying vacuum to the warm-up regulator.

To do this, connect the vacuum pump to the intake-manifold-pressure connection port of the warm-up regulator on the top of the housing. The picture shows testing with the recommended Mityvac hand vacuum pump.

Setting value for testing: 510...550 mbar (385...415 mmHg)

The "cold" control pressure is indicated on the pressure gauge of the pressure tester.



p = Control pressure (bar or kgf/cm² gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 038

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

Example: Ambient temperature = 20°C
Nominal control pressure = 1.1...1.5 bar gauge pressure

If the measured "cold" control pressure differs from the nominal value, this may be due to one of the following faults:

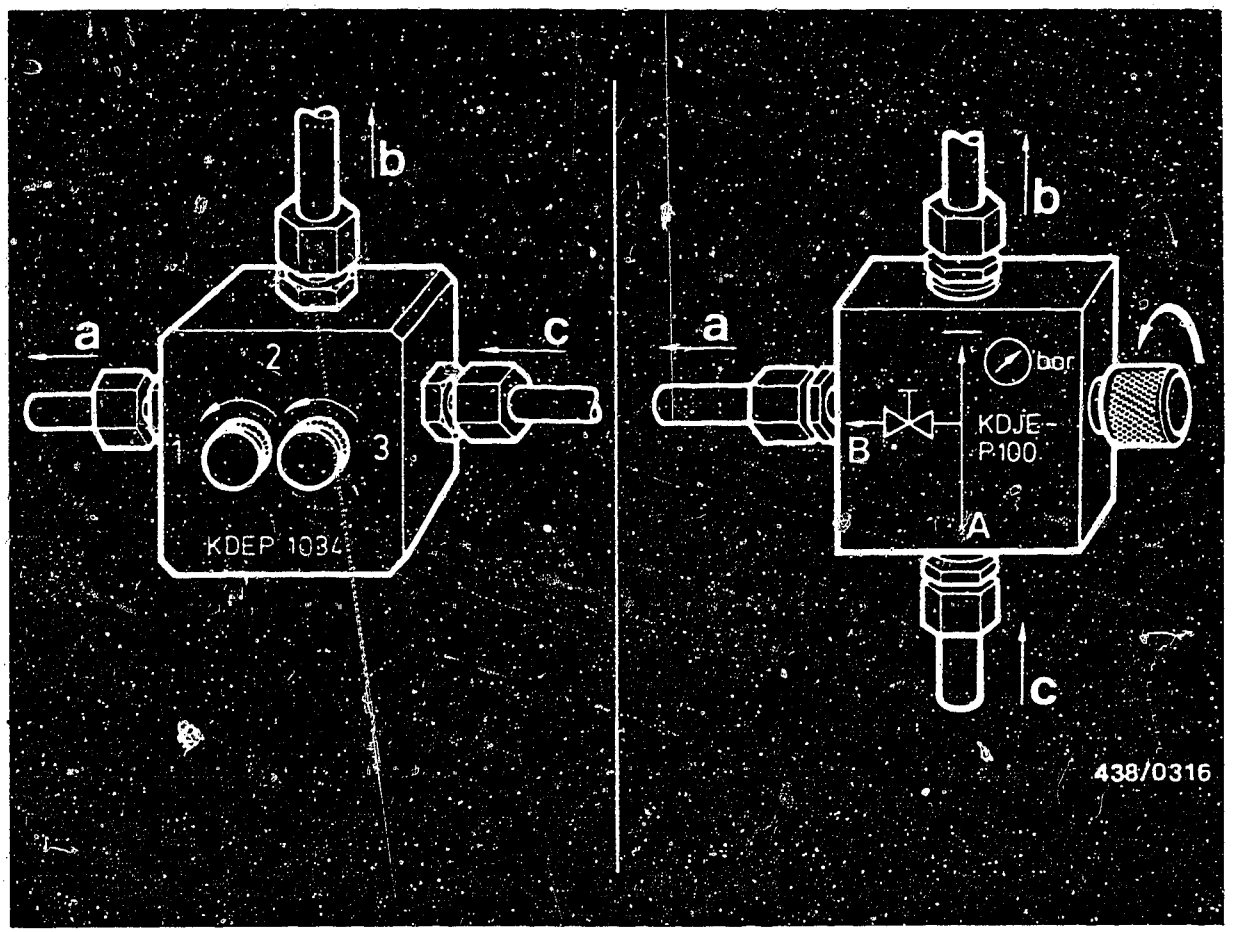
- Fuel delivery for the control pressure circuit too low or too high. Test fuel delivery.
  Test value: 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted (if control pressure too high).
  Eliminate constriction.

- Warm-up regulator defective.
  Replace warm-up regulator.
  When reconnecting the fuel lines to the warm-up regulator, use new seal rings.

If a fault has to be remedied or the warm-up regulator replaced, finally check the idle adjustment and, if necessary, correct.

Idle adjustment is described on Coordinate F 6.

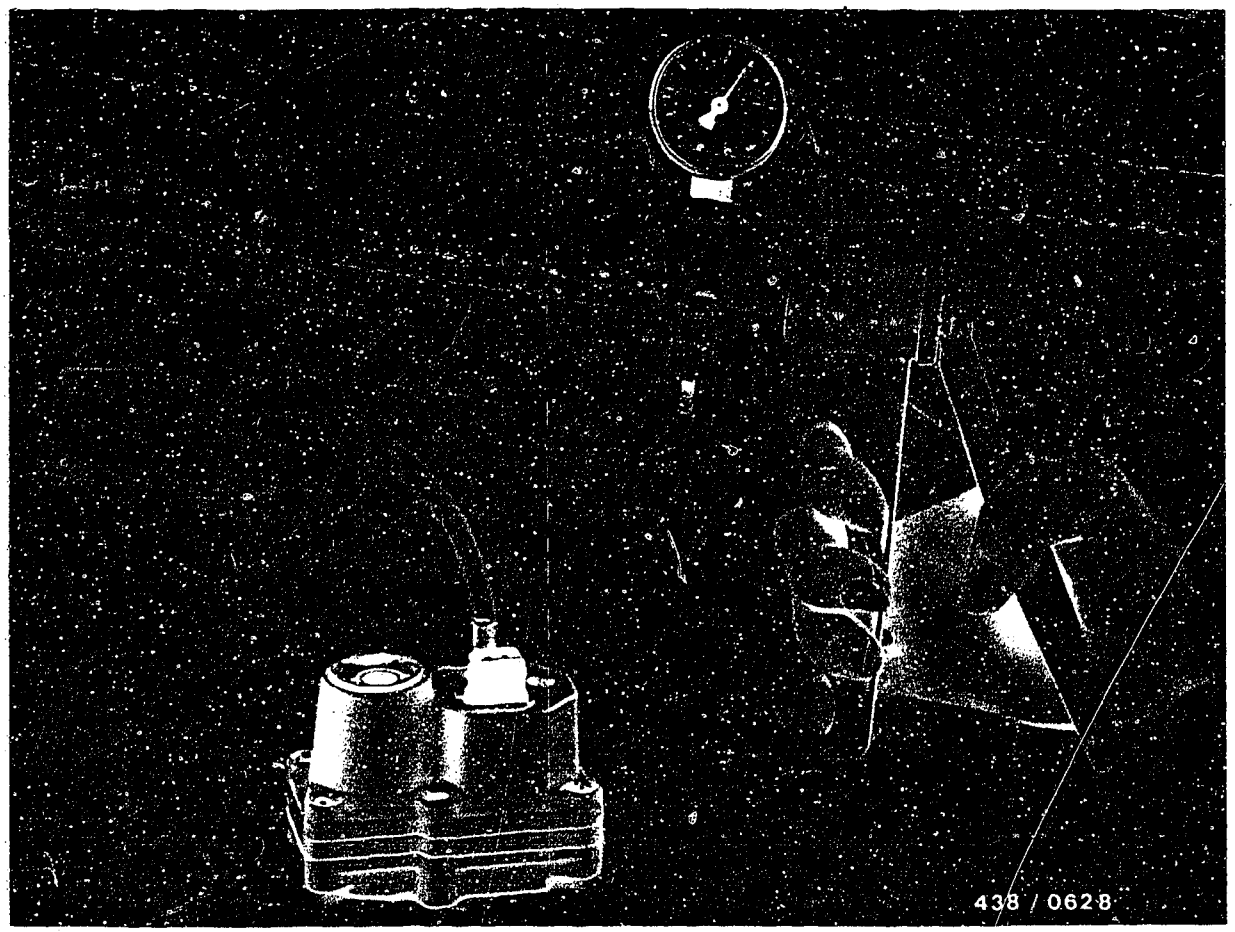


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.8 Testing the "cold" control pressure:

Fuel distributor Part No.: 0 438 140 038

The test is performed with the engine switched off, once without intake-manifold pressure being applied, once with simulated intake-manifold pressure (vacuum) applied. Open the valve screw of the directional-control valve (or both valves in the case of KDEP 1034).



For testing with simulated intake-manifold pressure, connect the vacuum pump to the intake-manifold-pressure connection port of the warm-up regulator (on the top of the housing near the plug housing).
The picture shows testing with the recommended Mityvac hand pump.

Setting value for testing: 510...550 mbar (385...415 mmHg)

Test procedure:

The temperature of the engine is not important.

Open the hollow screw of the directional-control valve (both in the case of KDEP 1034).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Plug the plug onto the warm-up regulator.

The control pressure increases (warm-up regulator in the process of shutting off) until the "warm" control pressure is reached.

Test first of all without the application of intake-manifold pressure, then test with simulated intake-manifold pressure (vacuum) in accordance with the values given below:

Test step	Test specifications*

"Warm" control pressure

Warm-up regulator part no.: 0 438 140 038
(Version for manifold-pressure-controlled full-load enrichment)

- Test with atmospheric pressure (without vacuum)

  3.0...3.4 bar (3.1...3.5 kgf/cm²)

- For testing, connect vacuum pump to intake-manifold-pressure connection of warm-up regulator.

  Setting values:
  510...550 mbar
  (385...415 mmHg 3.4...3.8 bar (3.5...3.9 kgf/cm²)

* Pressures in the test-specification table are given in bar (gauge pressure) and in kgf/cm² (gauge pressure).

If the measured "warm" control pressure differs from the test specification, this may be due to one of the following faults:

If control pressure too high:

- Fuel delivery for the control-pressure circuit too high.
  Test fuel delivery.
  Test specification: 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted. Eliminate constriction.

- Warm-up regulator has hydraulic defect.
  Replace warm-up regulator.

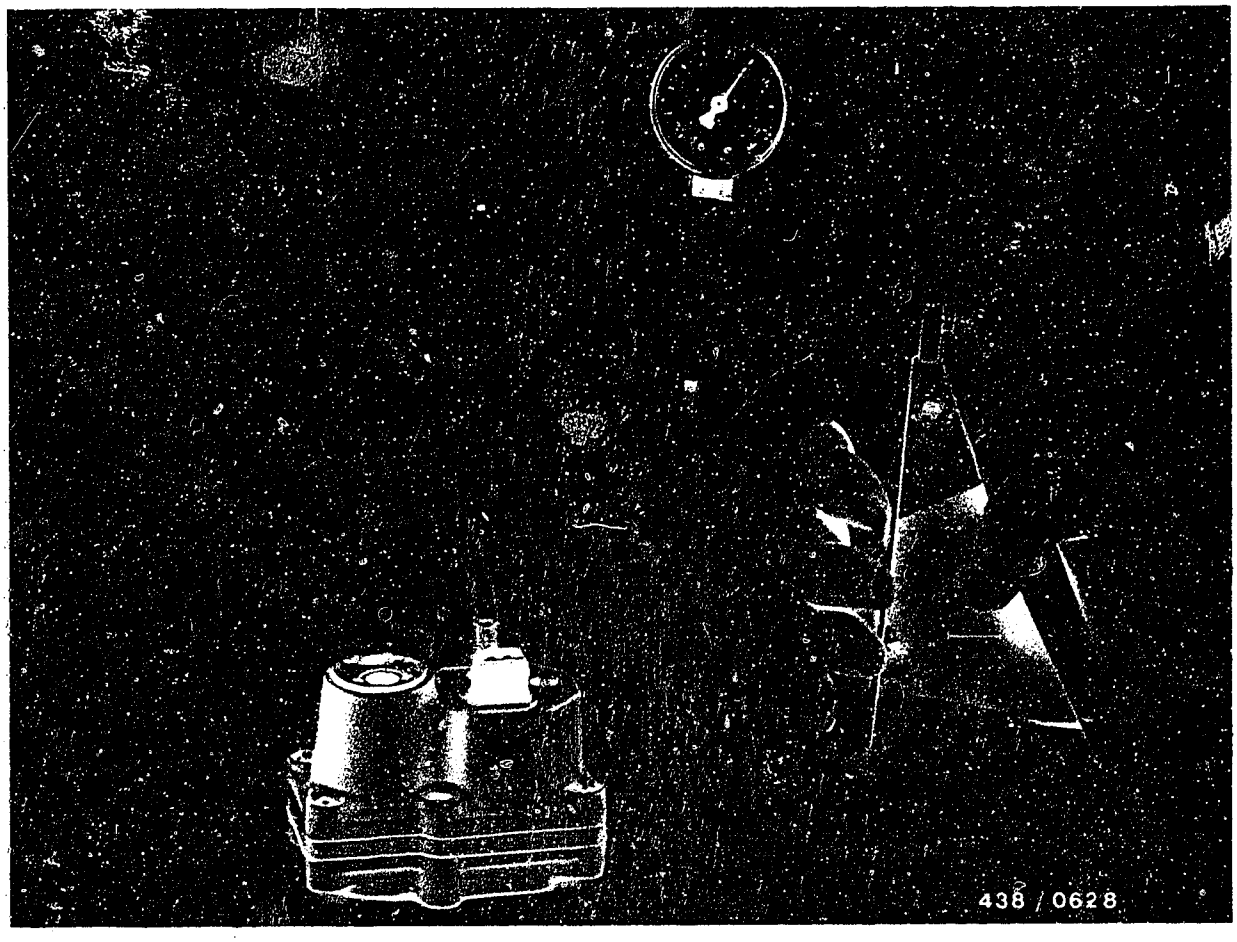
If control pressure too low:

- Power supply open-circuit.
  Eliminate open circuit. Ensure that the plug is contacting properly.

- Battery voltage too low, voltage drop.
  Eliminate voltage drop. Minimum voltage at connector: 11.5 V.
  If necessary, repeat test with engine running in order to obtain the normal generator voltage of approx. 14 V when the vehicle is in operation.

- Fuel delivery for the control-pressure circuit too low.
  Test fuel delivery.
  Test specification: 160...240 cm^3/min.

- Warm-up regulator defective. Heating coil open-circuit. Hydraulic defect. Replace warm-up regulator.



14.9 Testing the full-load diaphragm for leaks

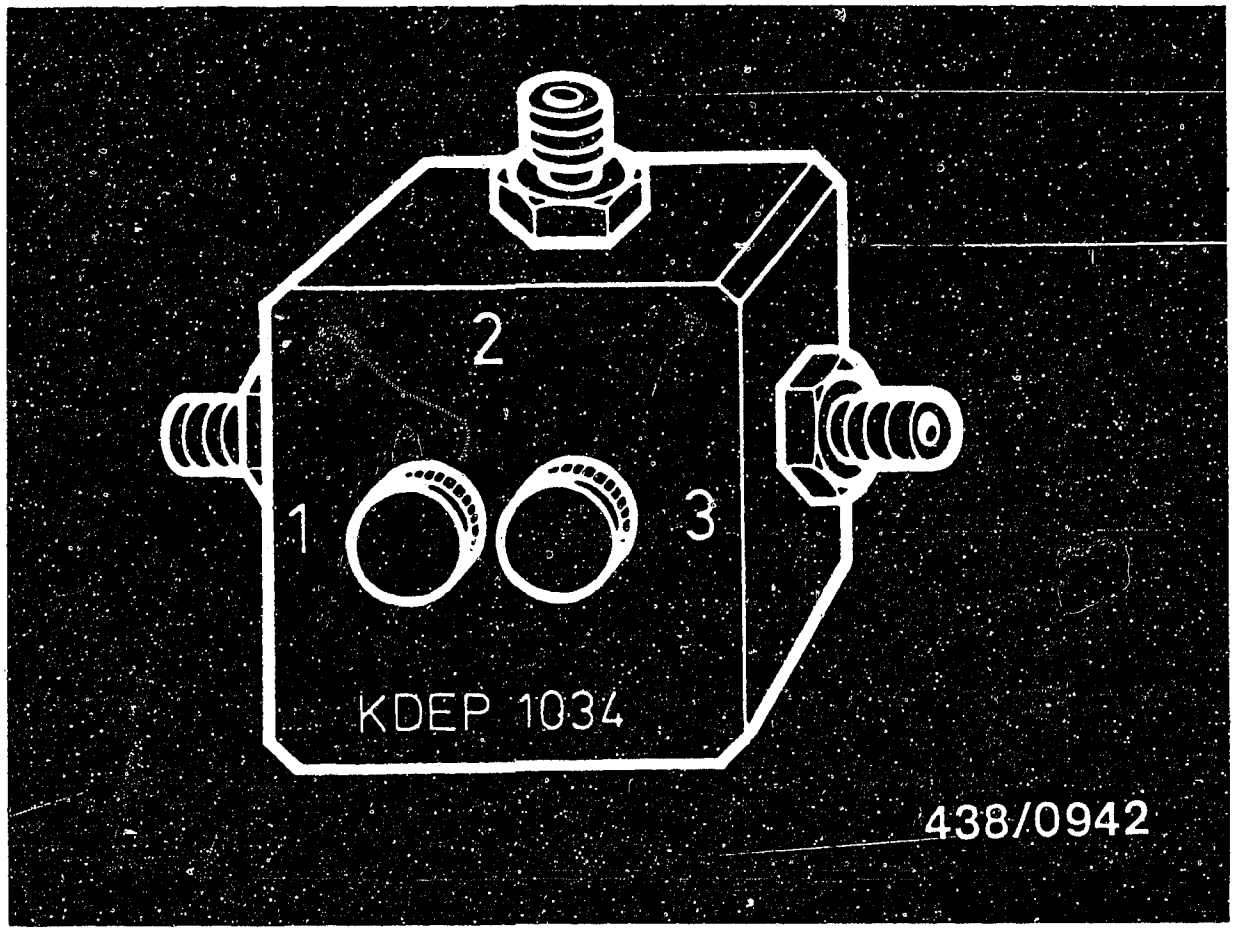
Switch off the electric fuel pump.
Connect the "Mityvac" hand vacuum pump to the intake-manifold-pressure connection port of the warm-up regulator and build up a vacuum.
Setting value: 510...550 mbar (385...415 mmHg)

Test specification for air leaks:
Max. pressure drop within 15 s 100 mbar (75 mmHg).
If the pressure drop is too great, replace the warm-up regulator.
When reconnecting the fuel lines to the warm-up regulator, use new seal rings.

Finally, check the condition and correct fitting of the connection hose from the intake manifold to the warm-up regulator. If necessary, replace the hose.

When the warm-up regulator has been replaced or a fault remedied carry out the idle adjustment with the engine at normal operating temperature.

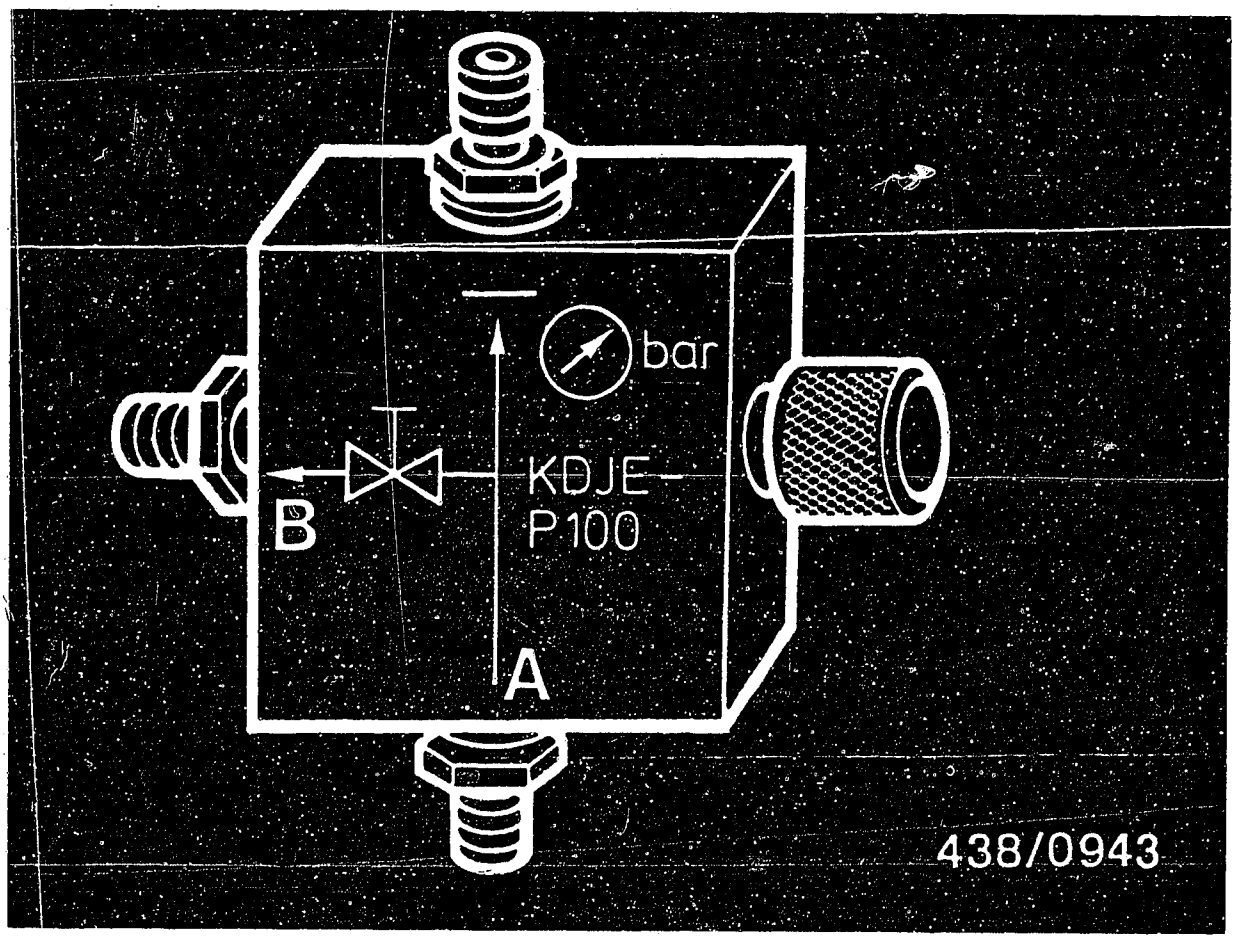
Idle adjustment is described on Coordinates F 6.



15. Testing and adjusting the primary (system) pressure:

15.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

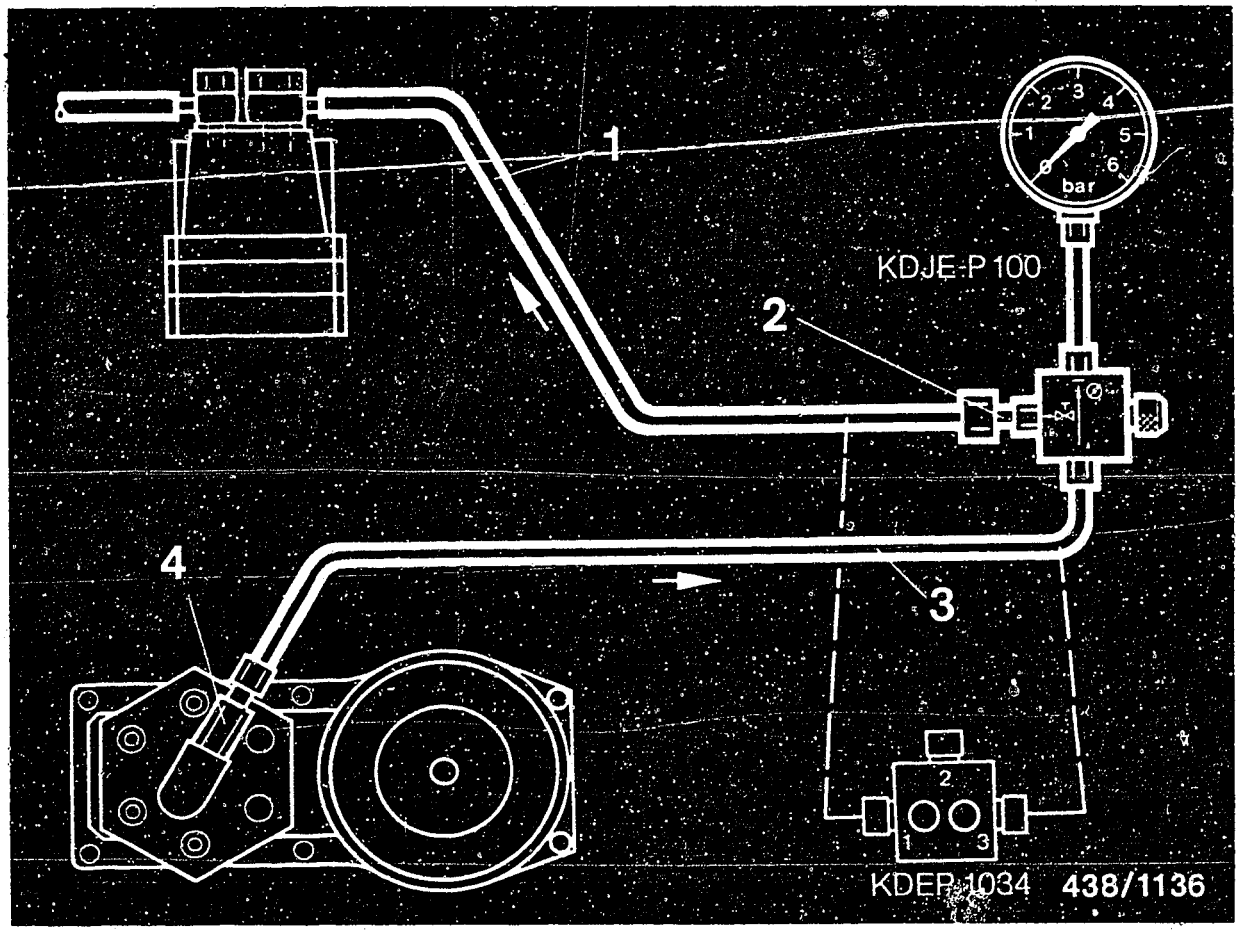
The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).



Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

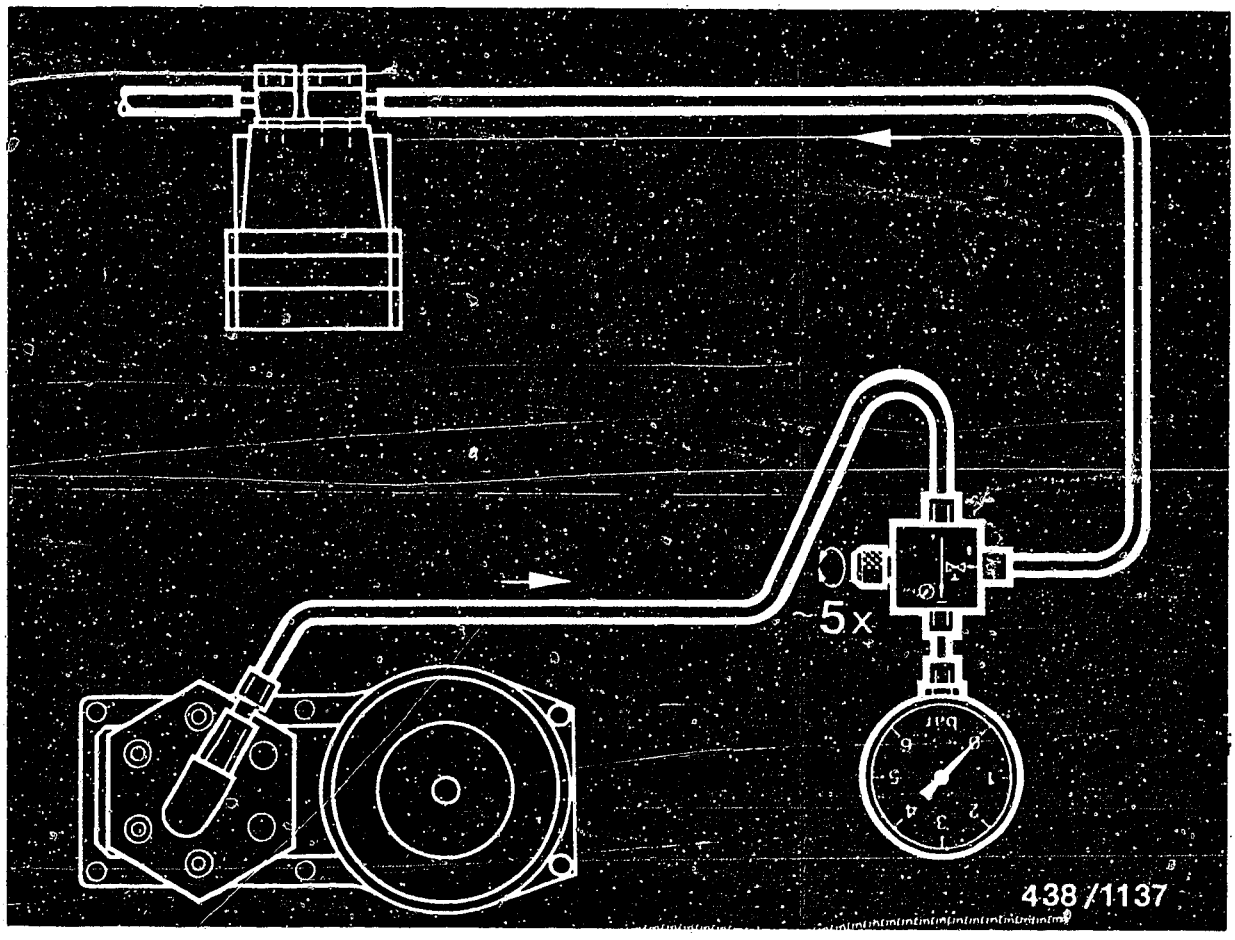


The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew control-pressure line (1) from fuel distributor and connect to outlet fitting B or 1 (2) of directional-control valve.

Connect hose line (3) of pressure tester to control-pressure connection port (4) of fuel distributor.

Suspend pressure gauge from hood (possibly using a wire hook).



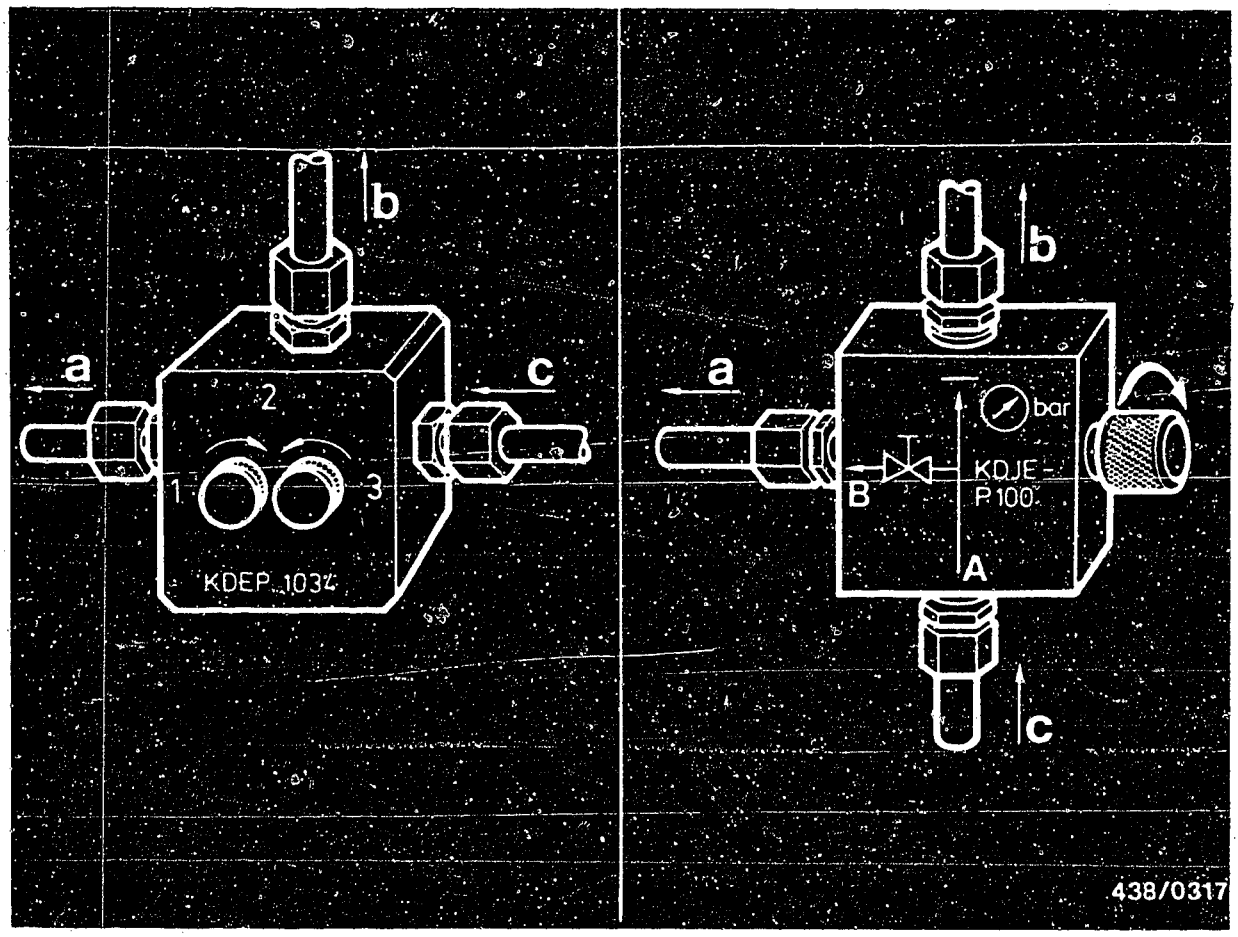
15.2 Bleeding the pressure tester

Remove electrical connector from warm-up regulator and auxiliary-air device.

Allow pressure gauge to hang down (extended hose line). Switch on electric fuel pump by bridging the electrical safety circuit.

Open and close hollow screw of directional-control valve (hollow screw 1 on KDEP 1034) approx 5 times in a 10-second rhythm.
Then re-attach pressure gauge to a suitable point (e.g. strut on hood).

Open hollow screw of directional-control valve (both screws in the case of KDEP 1034) (turn in a counter-clockwise direction).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.3 Testing the primary pressure:

The test is performed with the engine switched off. The temperature of the engine is not important.

Close the valve screw of directional-control valve KDJE-P 100. In the case of KDEP 1034, close valve screw 1, open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit.
Primary pressure is now indicated on the pressure gauge.

Part no. of fuel distributor	Test specifications for primary pressure*
0 438 100 025	4.5...5.2 bar (4.6...5.3 kgf/cm^2)

Possible causes of primary pressure being too low:

- Fuel supply not OK.
  (Delivery of electric fuel pump too low).

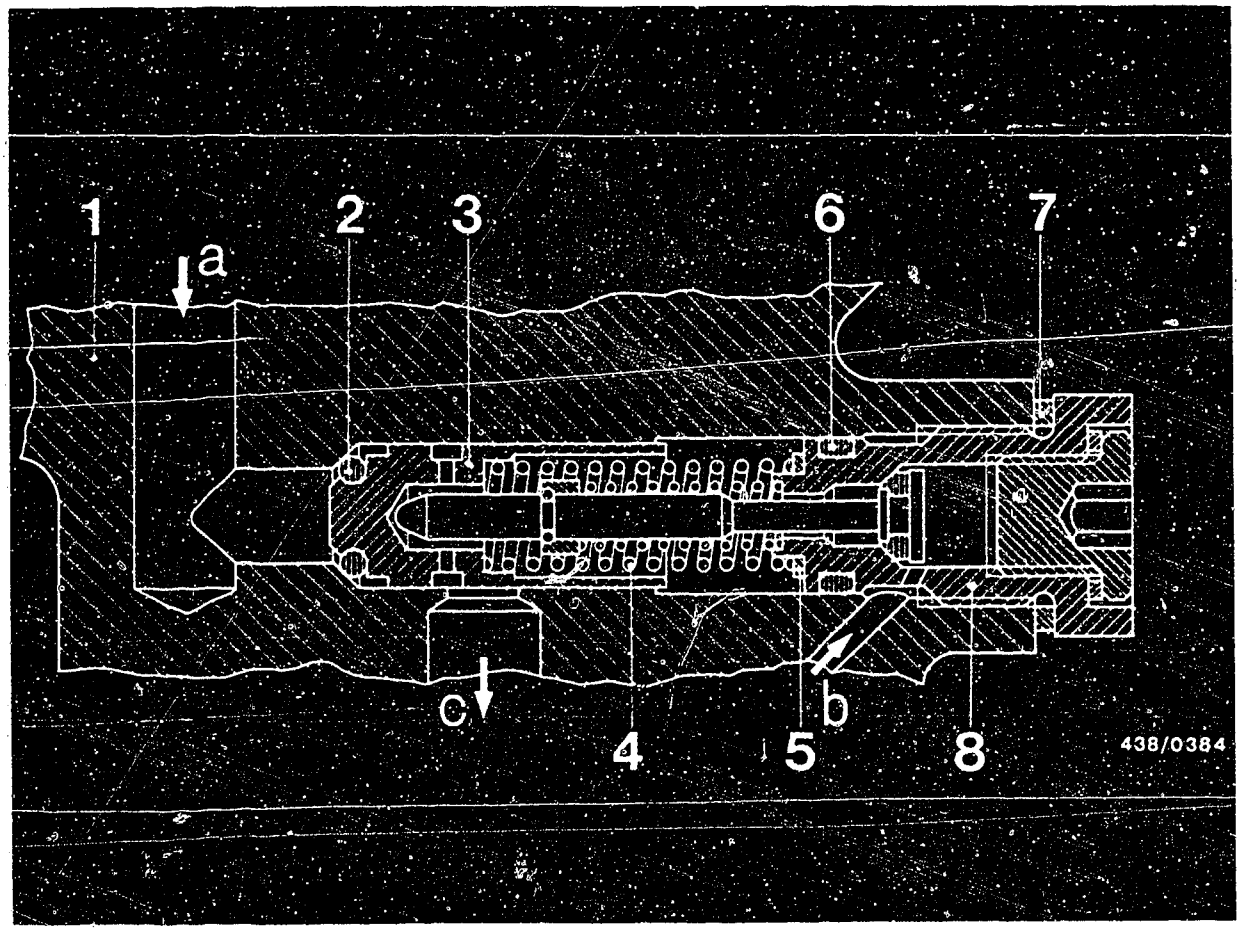
- Primary pressure incorrectly adjusted.
  Before re-adjusting primary pressure it must be ensured that the fuel supply is OK.
  Test specification: min. 930 cm^3/30 s.

Possible causes of primary pressure being too high:

- Constriction in the return line to the fuel tank.

- Primary pressure incorrectly adjusted.
  Before re-adjusting the primary pressure, therefore, always check first of all the condition of the return line to the fuel tank.

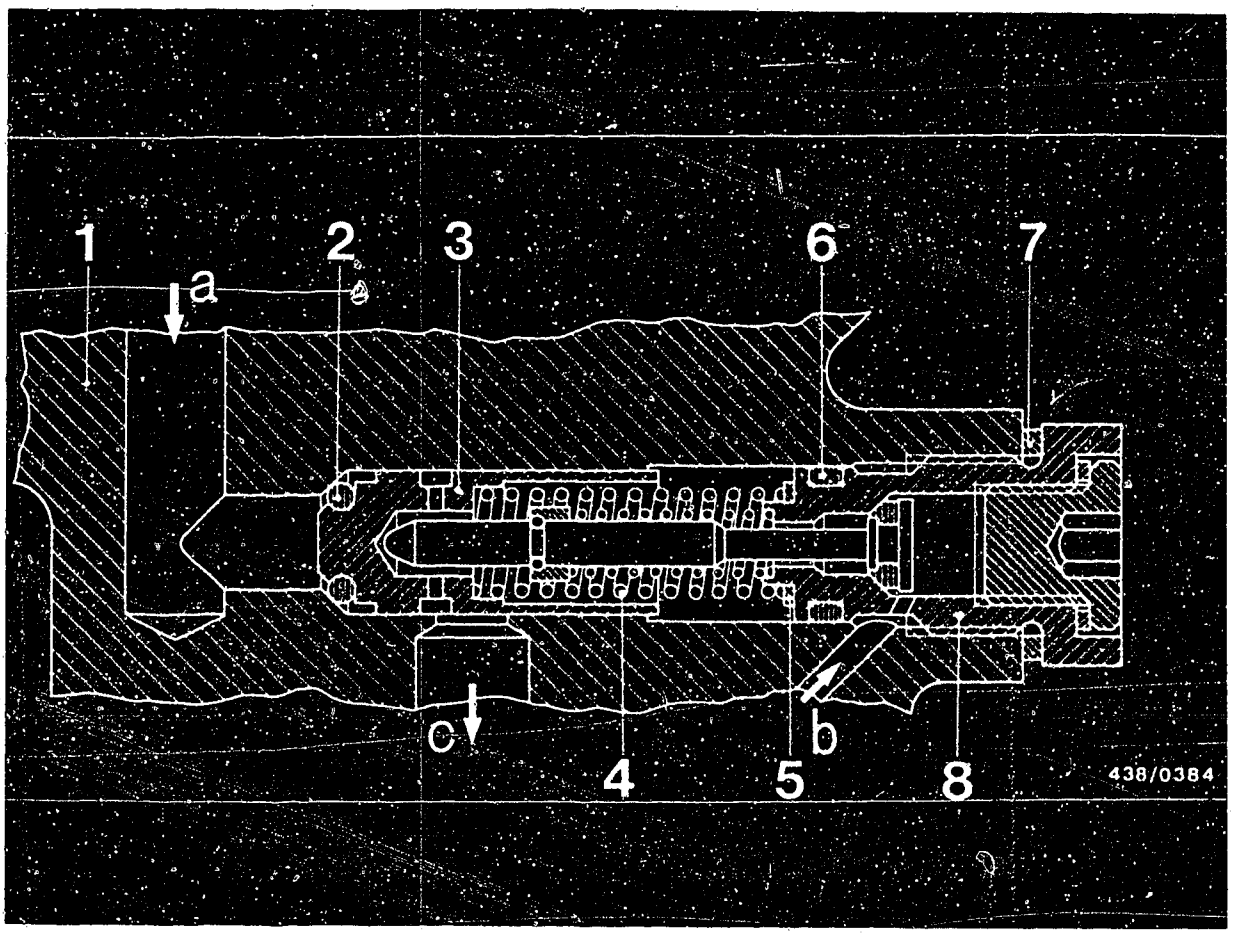
*Pressures are given in bar (gauge pressure) and/or in kgf/cm^2 (gauge pressure).



a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

15.4 Adjusting the primary pressure:

Fuel distributor Part nO.	Adjustment values - primary pressure (gauge pressure)
0 438 100 025	4.7...4.9 bar (4.8...5.0 kgf/cm²)

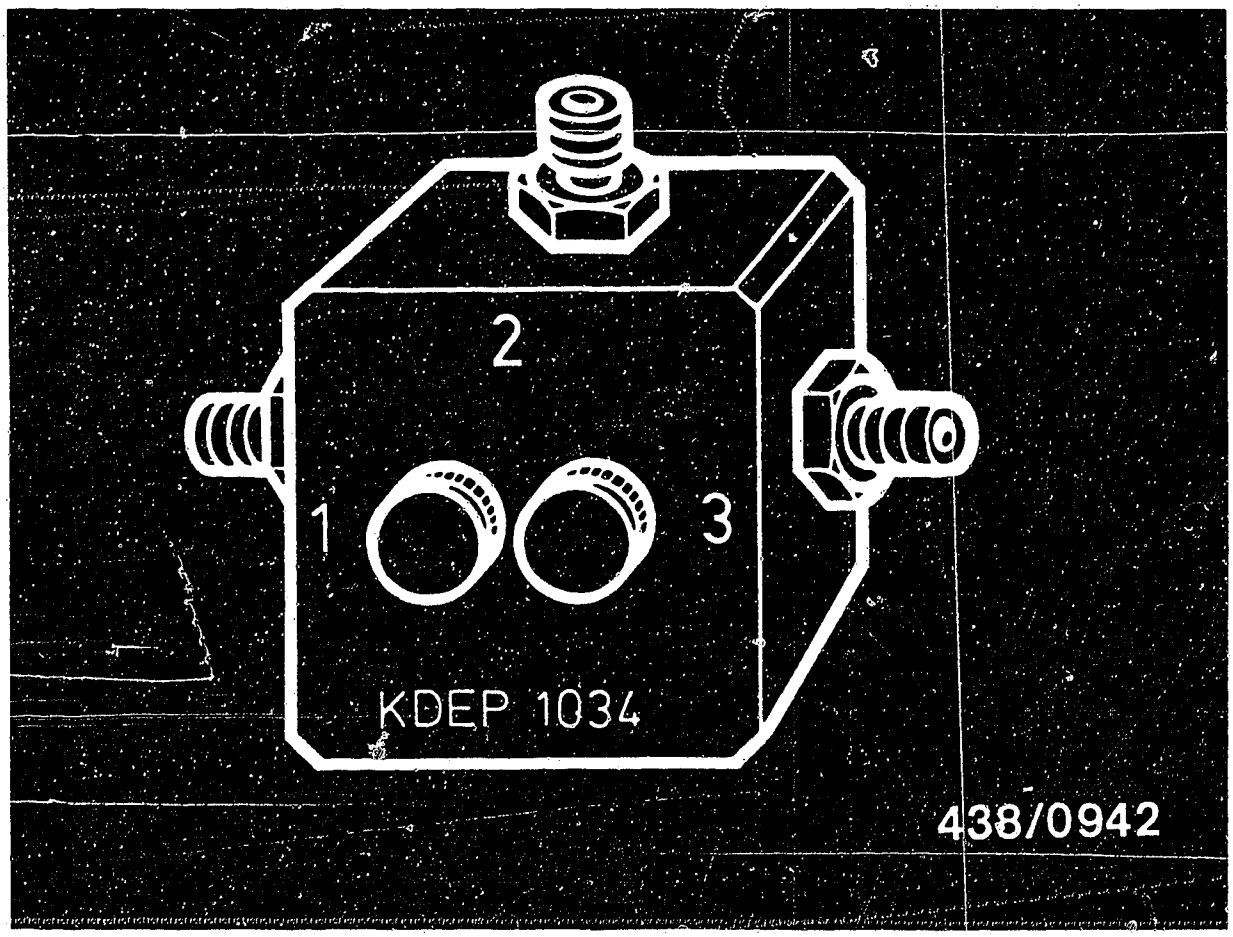


The primary pressure is readjusted by replacing the shims (Item 5).

Note:
0.1 mm more of shim thickness means about 0.15 bar pressure increase and vice versa.

To do this, screw out the large screw plug (Item 8) together with the push valve. After carrying out the adjustment, always fit the screw plug with a new flat seal ring (Item 7) and O-ring (Item 6).

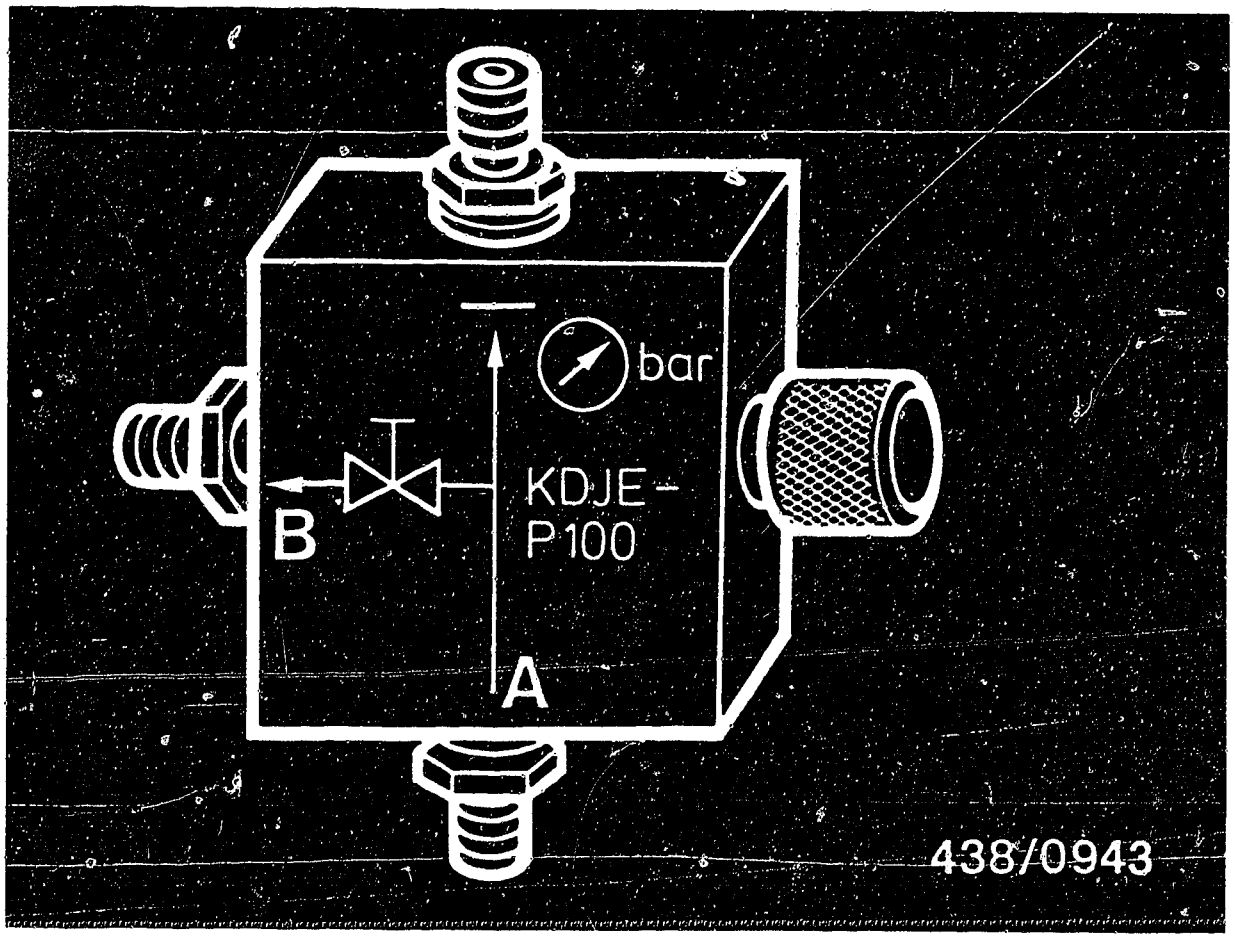
The control piston (Item 3) of the primary-pressure regulator must not be lost. It was matched specially to the fuel distributor housing in the manufacturing plant and therefore is the only part of the primary-pressure regulator which must not be replaced.



16. Testing the entire fuel system for leaks.

16.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

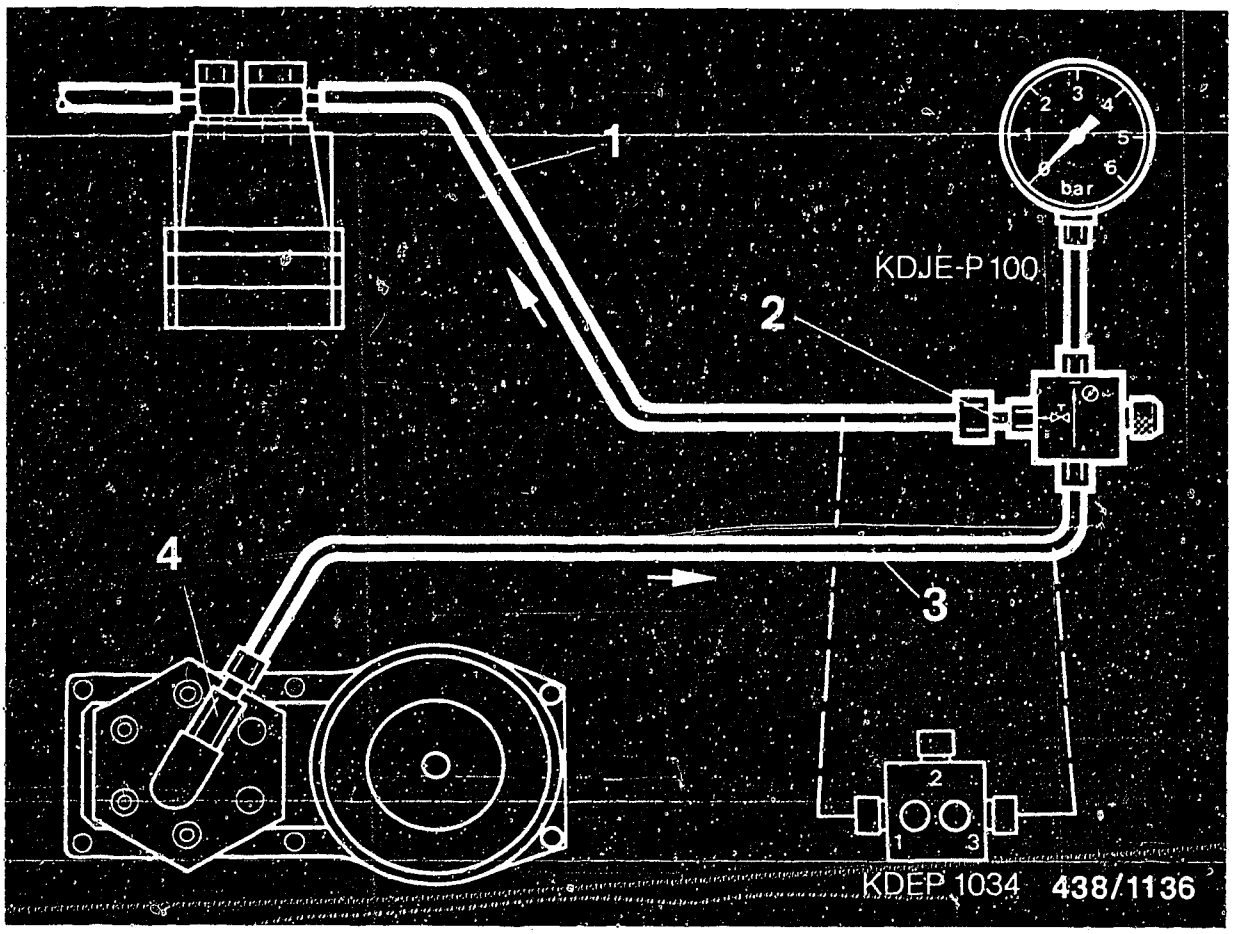


Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:

When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.

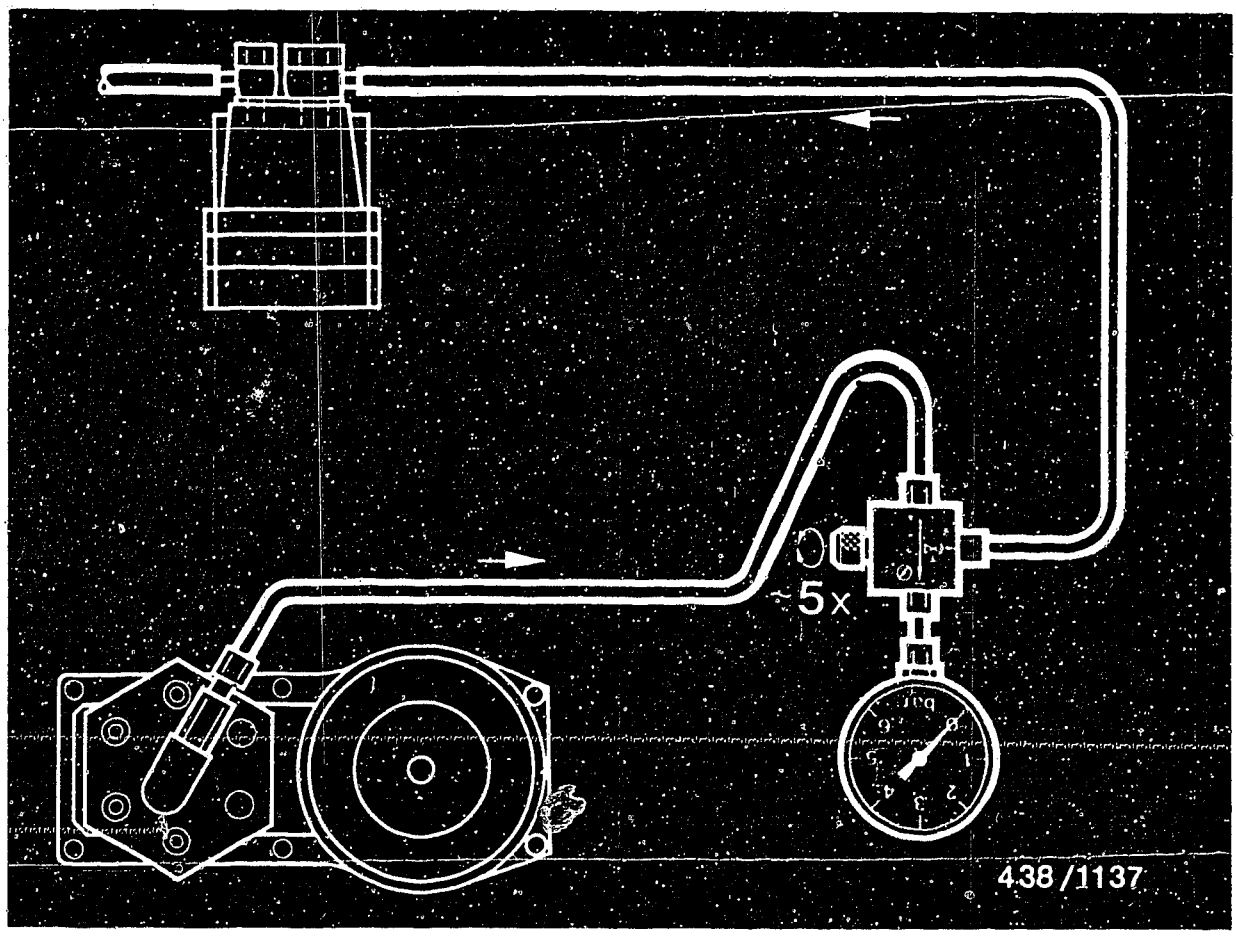


The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Unscrew control-pressure line (1) from fuel distributor and connect to outlet fitting B or 1 (2) of directional-control valve.

Connect hose line (3) of pressure tester to control-pressure connection port (4) of fuel distributor.

Suspend pressure gauge from hood (possibly using a wire hook).



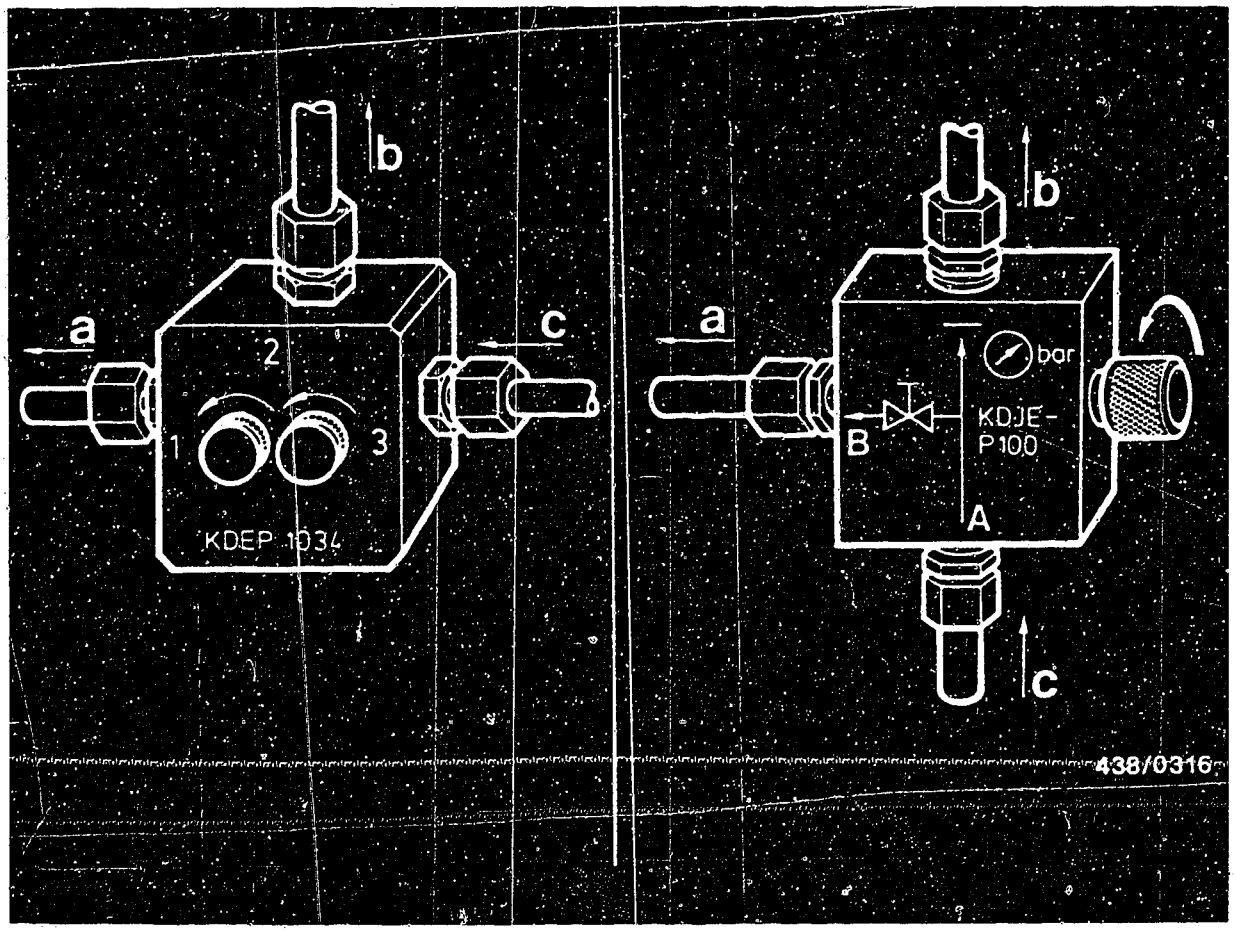
16.2 Bleeding the pressure tester

Remove electrical connector from warm-up regulator and auxiliary-air device.

Allow pressure gauge to hang down (extended hose line). Switch on electric fuel pump by bridging the electrical safety circuit.

Open and close hollow screw of directional-control valve (hollow screw 1 on KDEP 1034) approx 5 times in a 10-second rhythm.
Then re-attach pressure gauge to a suitable point (e.g. strut on hood).

Open hollow screw of directional-control valve (both screws in the case of KDEP 1034) (turn in a counter-clockwise direction).

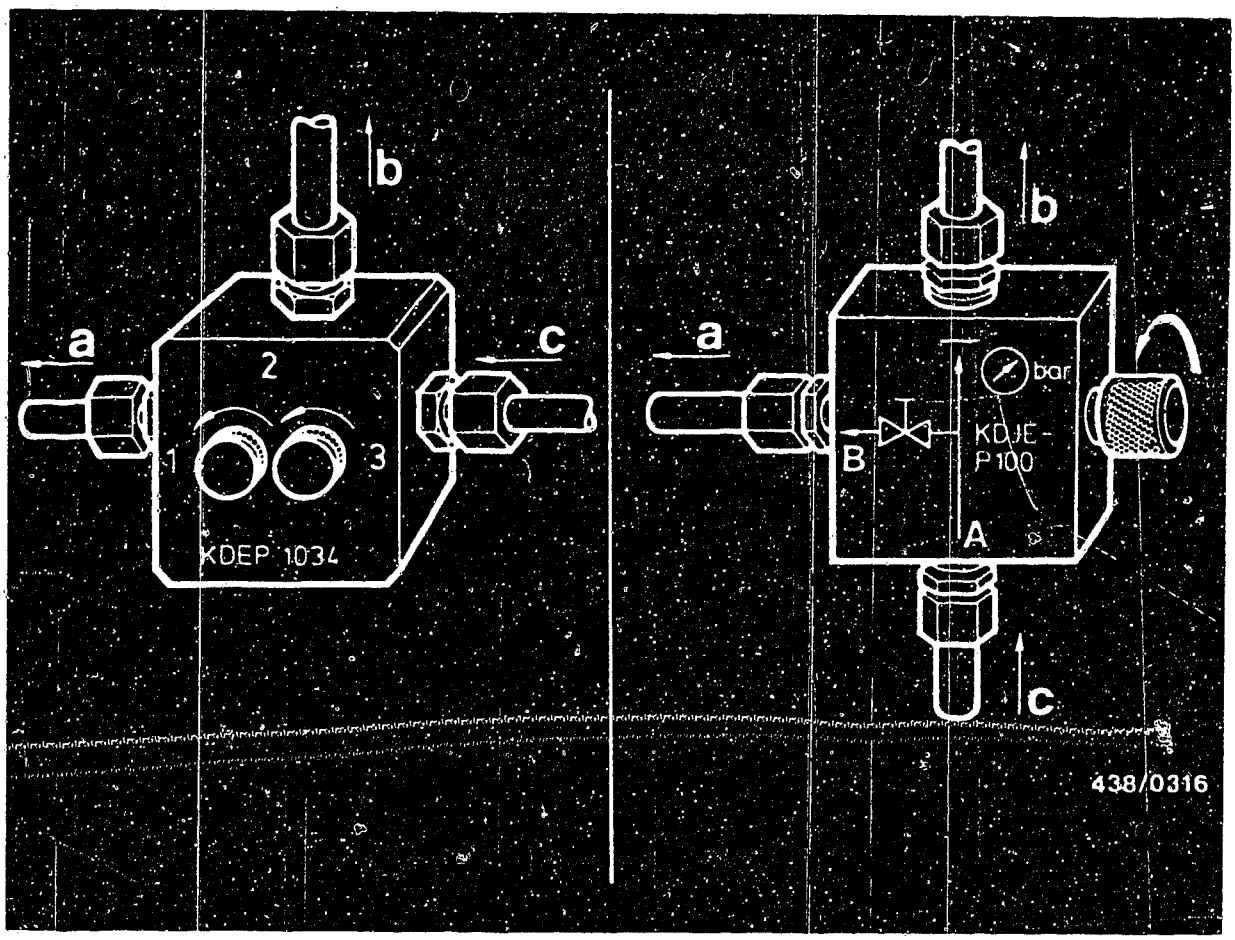


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Leak test:

The test is performed with the engine switched off. Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.

Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).

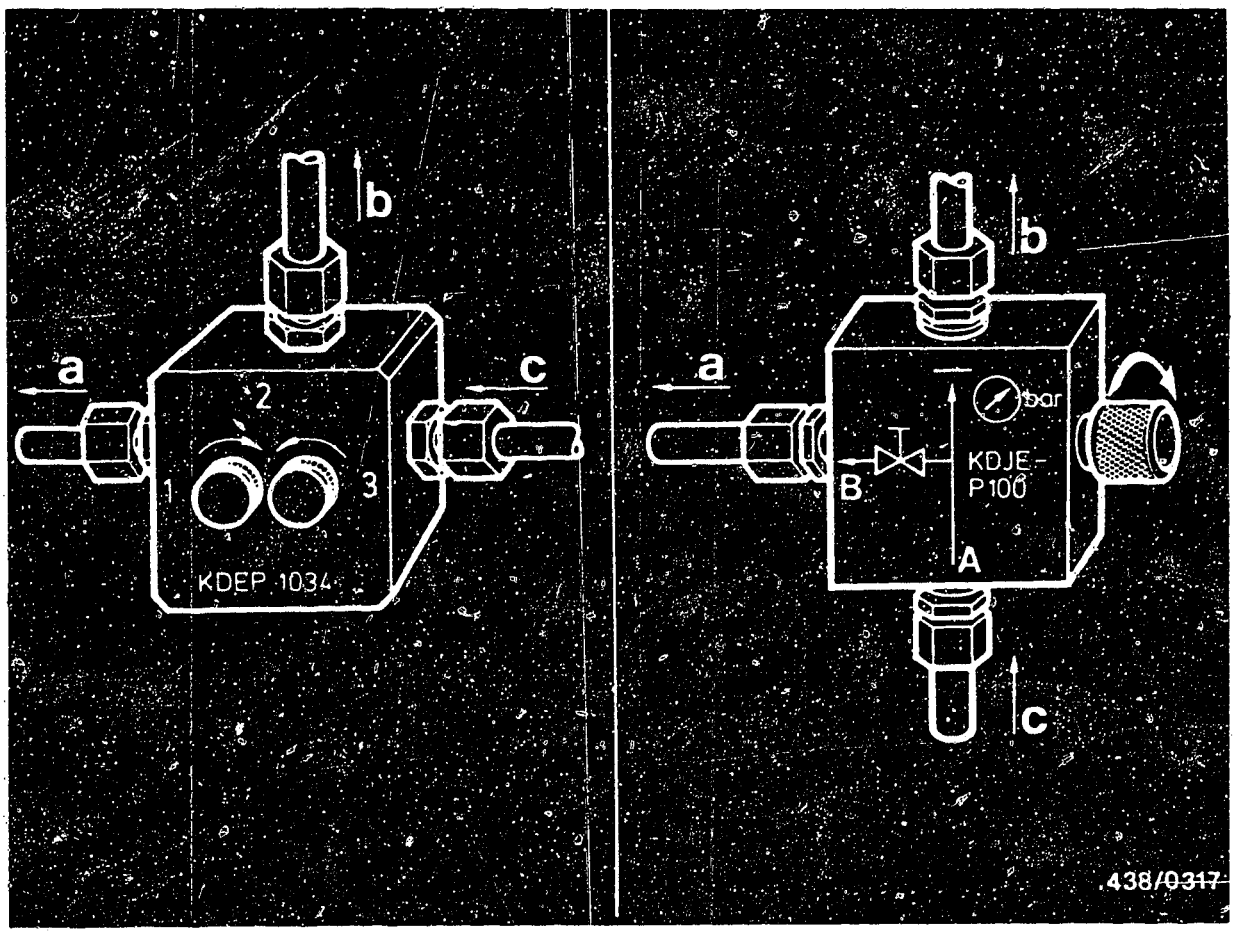


Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).

Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.
Test specifications for leak test:

Minimum pressure after:

10 minutes: 2,0 bar (2,1 kgf/cm²) gauge pressure
20 minutes: 1,7 bar (1,8 kgf/cm²) gauge pressure

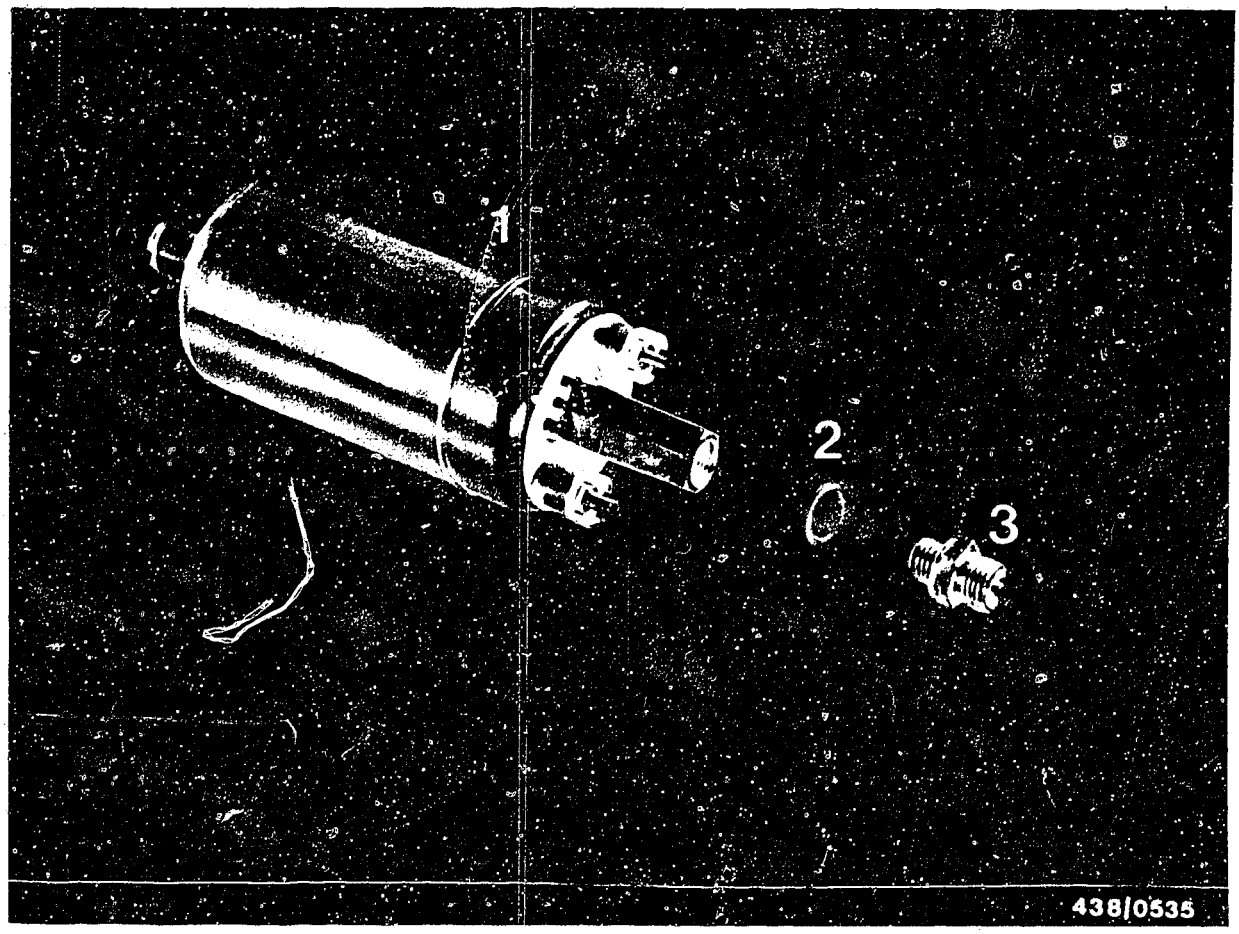


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

If the pressure drops too quickly, repeat the test with the control-pressure circuit disconnected.

Position of the valve screws:
Close the valve screw of the directional-control valve KDJE-P 100.
In the case of KDEP 1034, close valve screw 1, open valve screw 2.

If the same result is found, the leak is in the primary-pressure circuit.
If the test results are correct during the second test, the leak is in the control-pressure circuit.

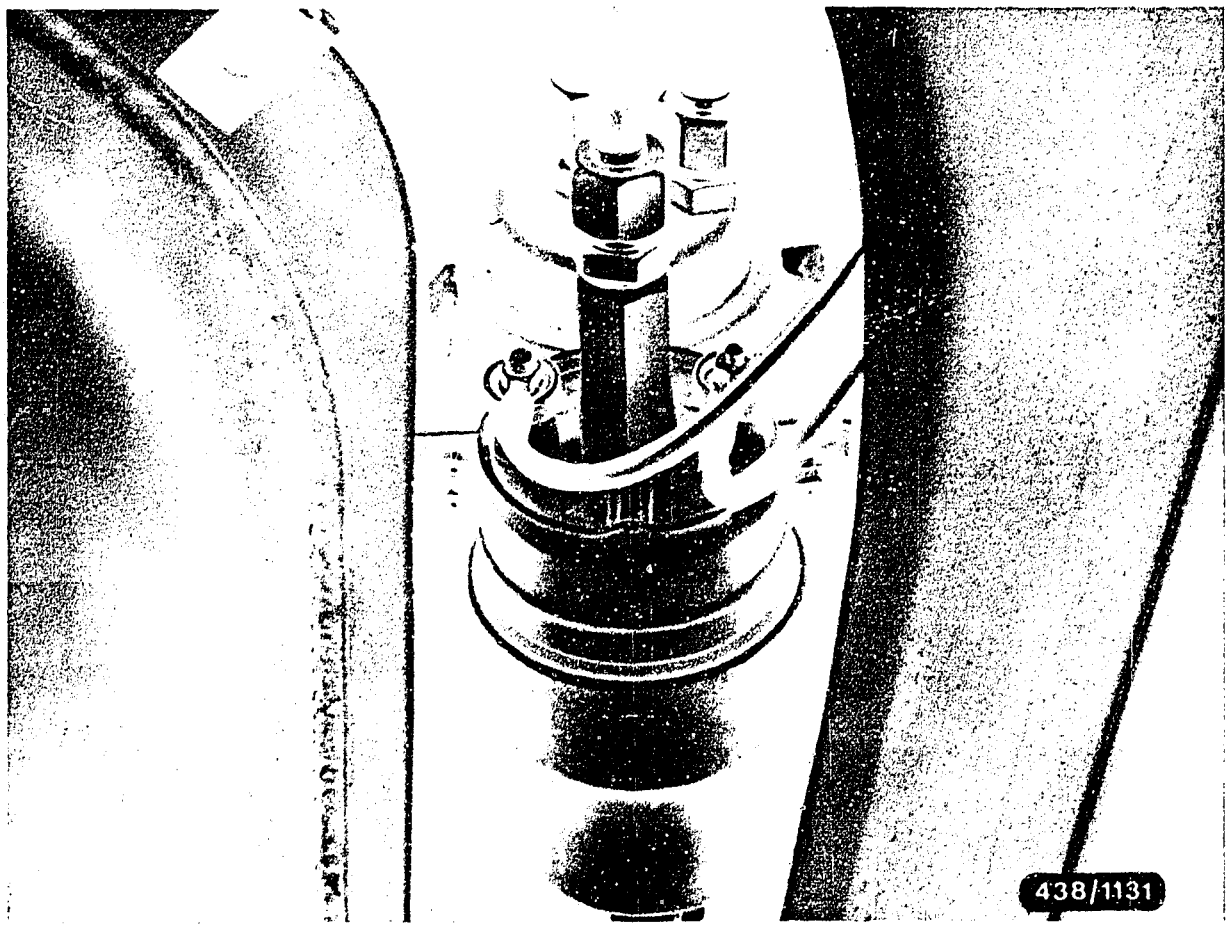


1 = Electric fuel pump
2 = Flat seal ring
3 = Tube fitting

16.4 Possible causes of a defect in the primary-pressure circuit:

- Non-return valve in the pressure connection piece of the electric fuel pump has a leak.

Electric fuel pump 0 580 254 984
The non-return valve is permanently installed in the pressure connection piece and cannot be replaced.
In order to avoid having to change the complete electric fuel pump when the non-return valve has a leak, a parts set with a separate non-return valve has been introduced and can be used on the above-mentioned electric fuel pump.
Part number of the parts set: 1 687 010 004.



The new non-return valve can be installed without removing the electric fuel pump:

Remove dirt-deflector plate (on right-hand side in forward direction of travel, next to fuel tank) so that electric fuel pump is made accessible.

Contents of parts set 1 587 010 004:

1 Tube fitting with built-in non-return valve
1 Seal ring

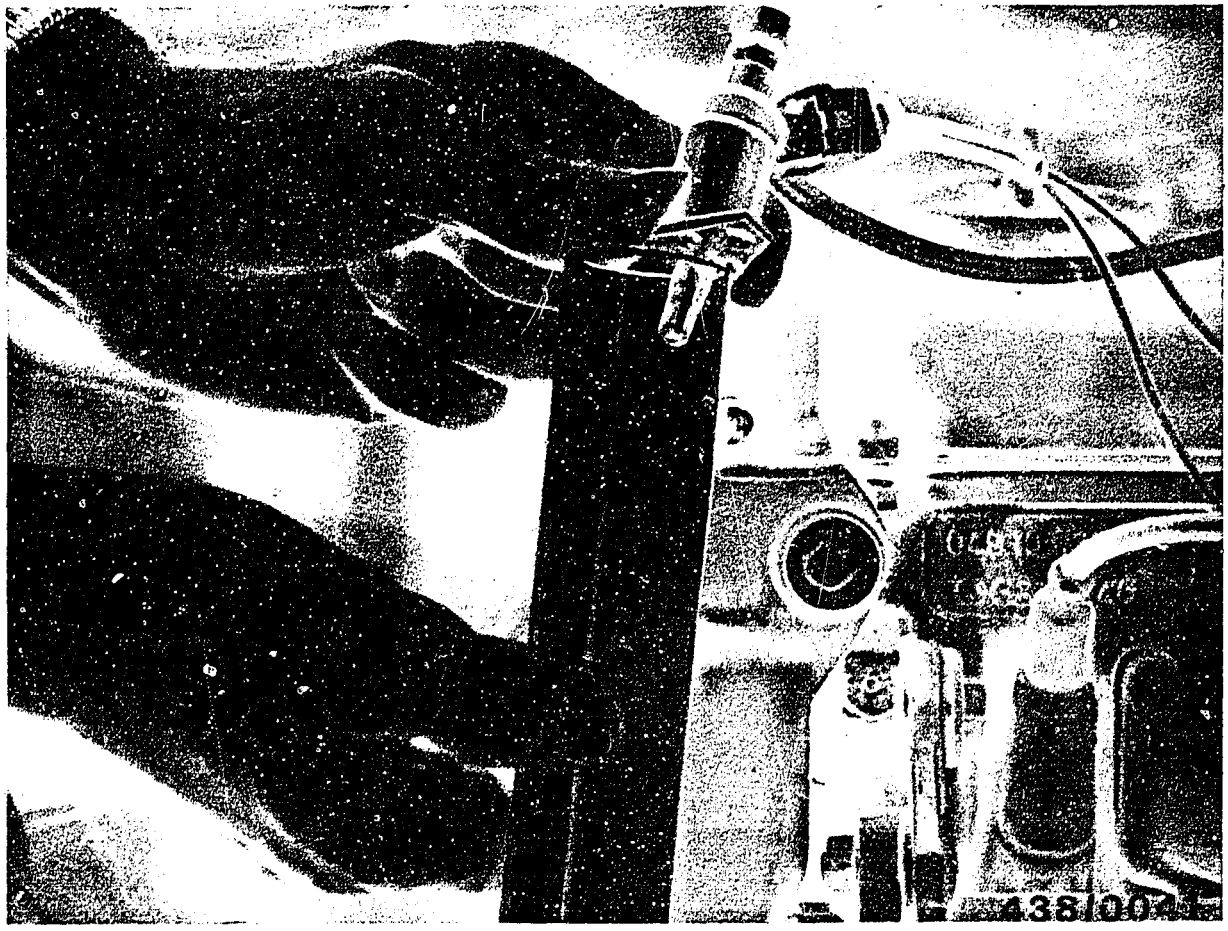
Installation:
Thoroughly clean the connection of the delivery line on the electric fuel pump.
Pinch off the intake hose (fuel tank - electric fuel pump) (e.g. using hose clamper W 157 from Matra Co.).
Screw off the delivery line, collecting any escaping fuel. Unscrew the double threaded connector out of the pressure connection piece.
The defective original non-return valve remains in the electric fuel pump.

Screw the tube fitting of the parts set (M 12x1.5) with a thick flat seal ring into the pressure connection piece and tighten to a torque of 17...25 Nm while at the same time applying a wrench to the hexagonal section of the pressure connection piece.

Connect the fuel delivery line.

Remove the hose clamper from the intake hose.

Check connections for leaks with the electric fuel pump in operation.



Further possible cause of leaks in the primary-pressure circuit:

- Start valve leaking.

Remove the plug from the start valve and remove the start valve. The fuel line remains connected.

Hold the start valve in a suitable vessel (e.g. a graduate).

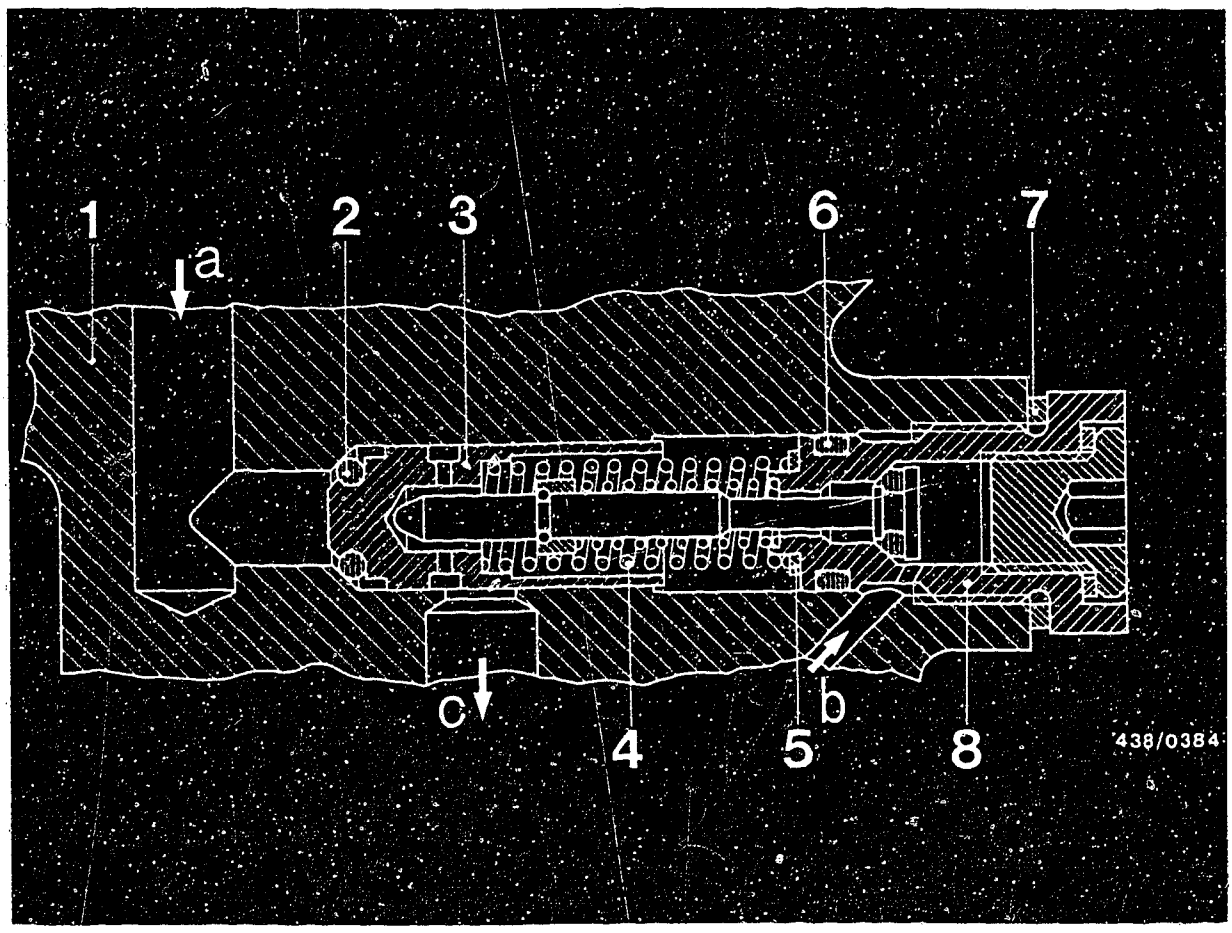
Switch on the electric fuel pump by bridging the electrical safety circuit so that primary pressure is applied to the start valve.

Dry off the nozzle of the cold-start valve.

No drops must fall from the nozzle of the start valve within the next minute. Even when shaken and knocked, the start valve must not leak.

Switch the electric fuel pump off again.

Replace the cold-start valve if leaky.
Finally, adjust idle speed with the engine at operating temperature.
Idle-speed adjustment is described on Coordinates F 6.



a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

- Seal ring (O-ring) on control piston of primary-pressure regulator has a leak.

Replace the seal ring;
Clean the fuel distributor in the region of the prima pressure regulator.

Unscrew the large screw plug (8) with the complete push-up valve. Also remove the shims (5), control spring (4) and control plunger (3).

Replace the seal ring (O-ring) (2) on the control plunger. Install the control plunger and the control spring.

Screw in the screw plug with the complete push-up valve and with shims (as found when removing) and new seal rings (6 and 7).

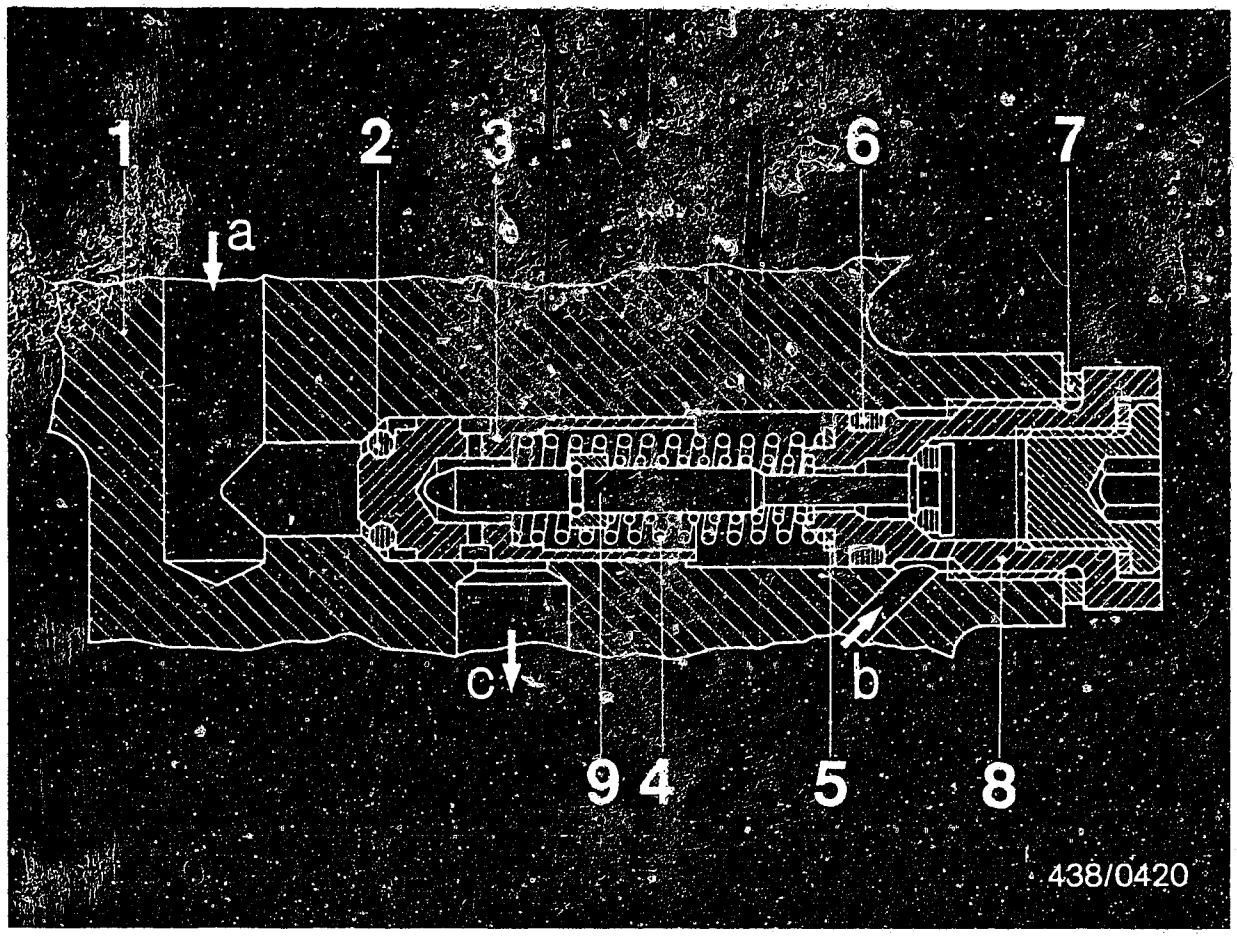
Finally, check the primary pressure and, if necessary, adjust by changing the shims (5).

Primary pressure:

Fuel distributor 0 438 100 025

Checking value $\frac{4.5...5.2 \text{ bar}}{\text{pressure}}$ (4.6...5.3 kgf/cm²) gauge

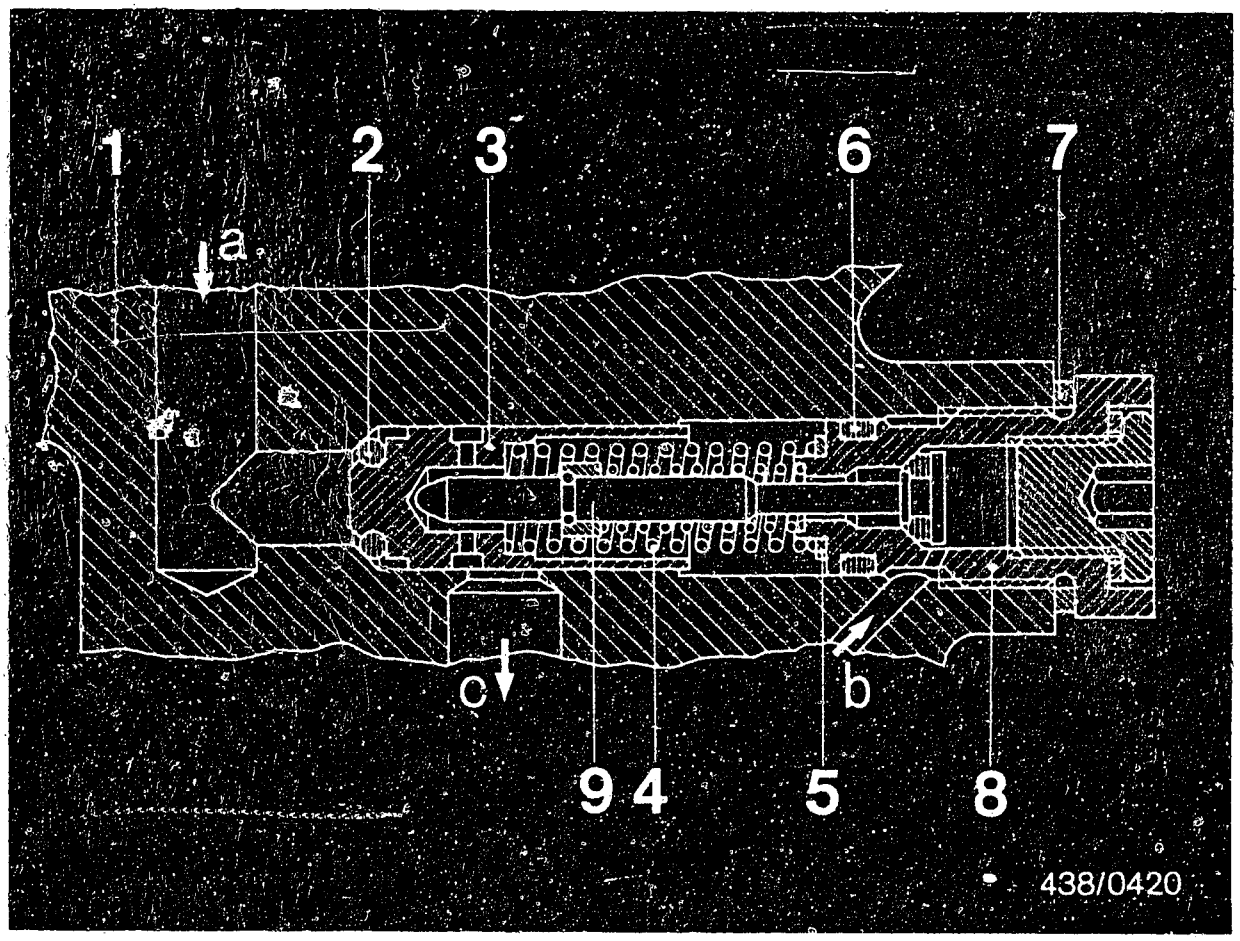
Setting value $\frac{4.7...4.9 \text{ bar}}{\text{pressure}}$ (4.8...5.0 kgf/cm²) gauge



a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug
9 = Push valve

16.5 Possible cause of trouble in control-pressure circuit

- Vehicles with fuel distributor 0 438 100 005 have no push valve for sealing the warm-up regulator return. In case of a leak in the control pressure circuit the warm-up regulator is the cause.
  Replace the warm-up regulator



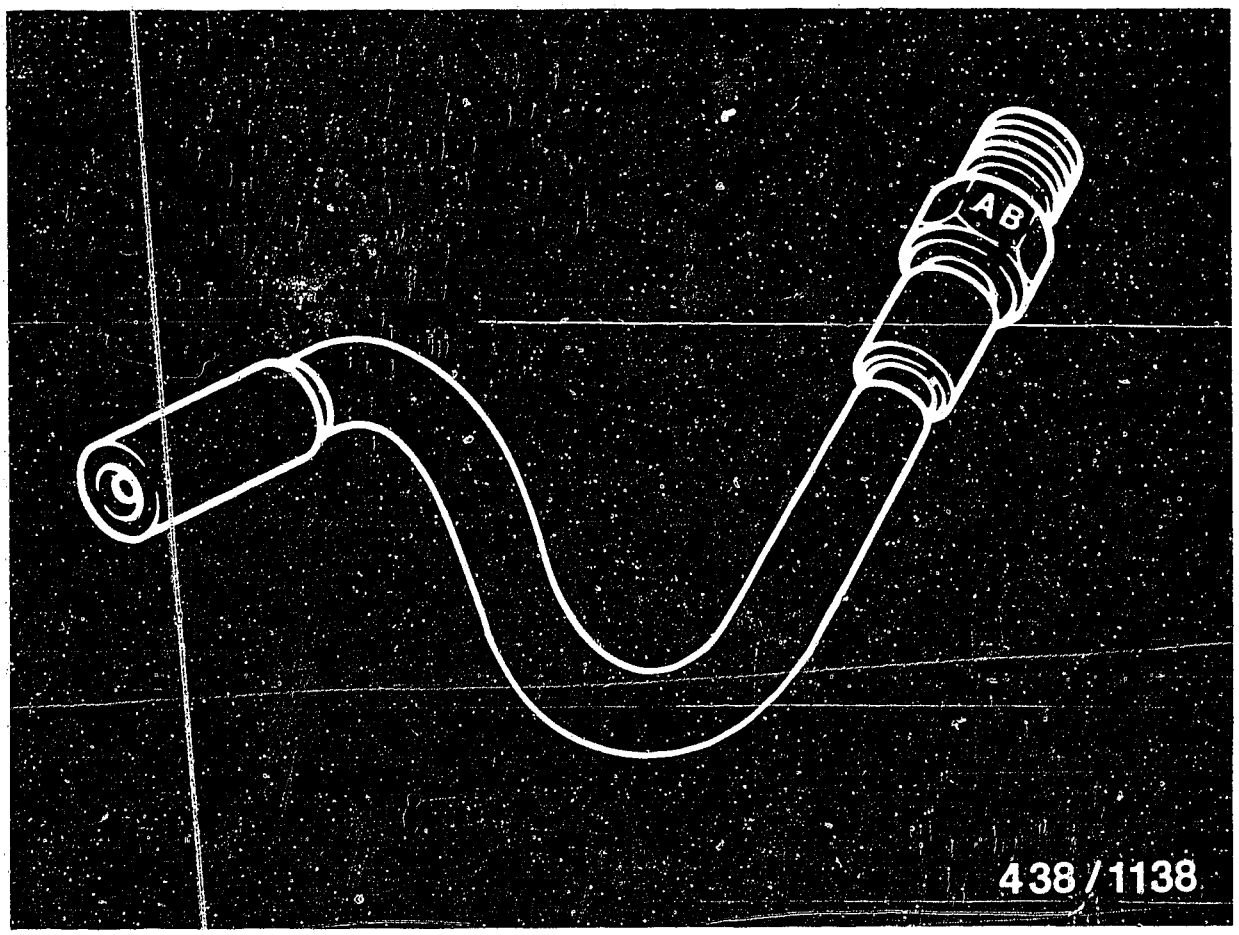
a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug
9 = Push valve

Clean the fuel distributor in the region of the primary-pressure regulator. Screw out the large screw plug (8) together with the complete push valve. Pay attention to control spring (4) and shims (5). Screw in new push valve using the number of shims (5) as when removed, new O-ring (6) and flat seal ring (7). Finally, check the primary pressure and, if necessary, adjust by changing the shims (5).

Primary pressure, test and setting values (gauge pressure)

Fuel distributor Part No. 0 438 100 025

Checking value: 4.5...5.2 bar (4.6...5.3 kgf/cm²)
Setting value : 4.7...4.9 bar (4.8...5.0 kgf/cm²)



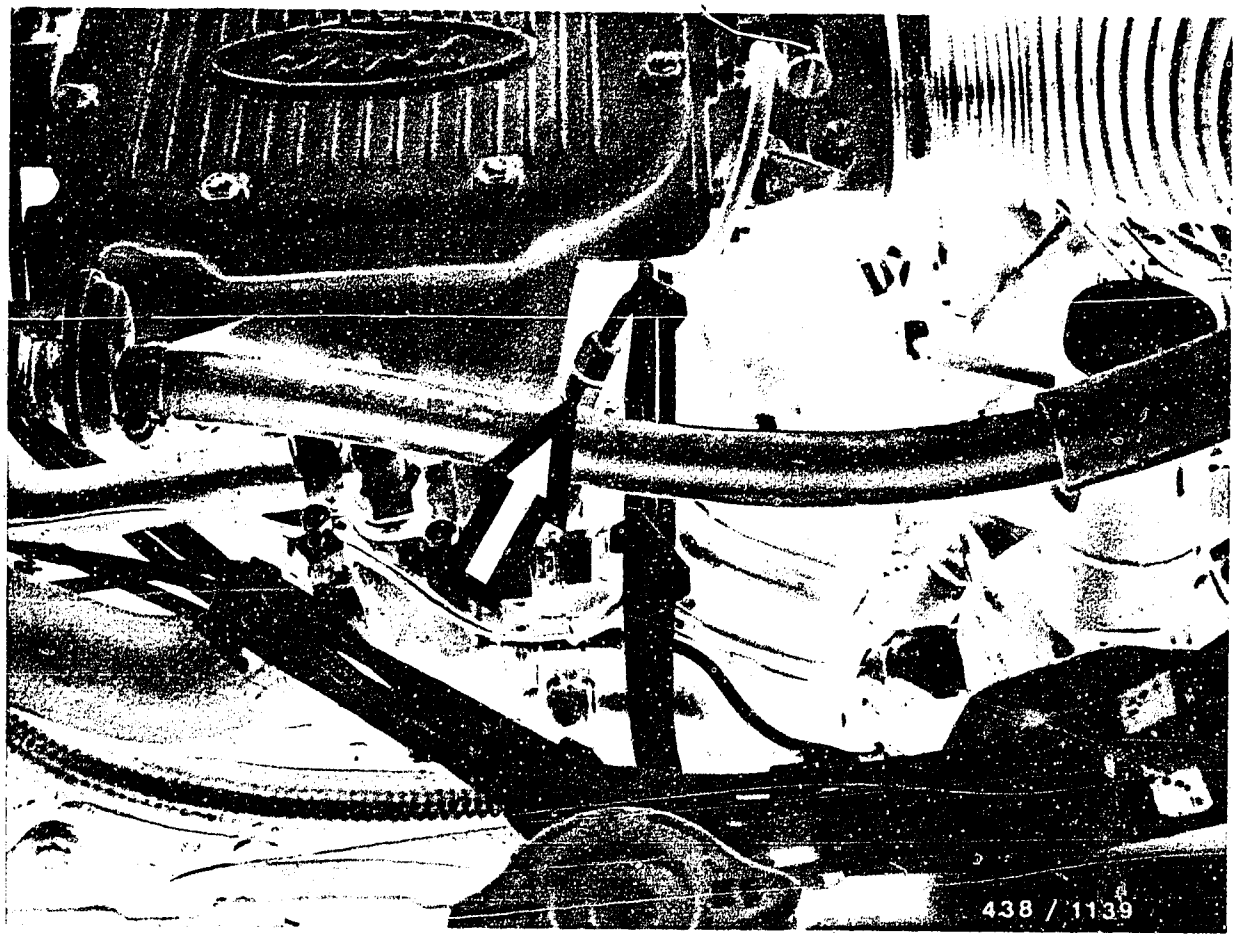
17. Testing the injection valves

Remove injection valves for testing.

Note:

The 1977 model Granada is the only K-Jetronic vehicle with bent injection valves.

However, their operating principle and method of testing is exactly the same as for the known, straight-type injection valve.



Removing and installing the injection valves

The injection valves are inserted into appropriate mounting holes in the intake ports.

Due to the fact that the injection valves are bent, in the first production vehicles the injection valves can only be removed by removing the air-chamber cover and loosening the air chamber and raising it slightly.

As of 631 date of manufacture the injection valves are modified so that removal and installation is possible without these additional removal operations.

Unscrew injection lines before removing (hold at fixed hexagonal section) and remove injection valves while turning at the same time.

17.1 Test equipment and test media

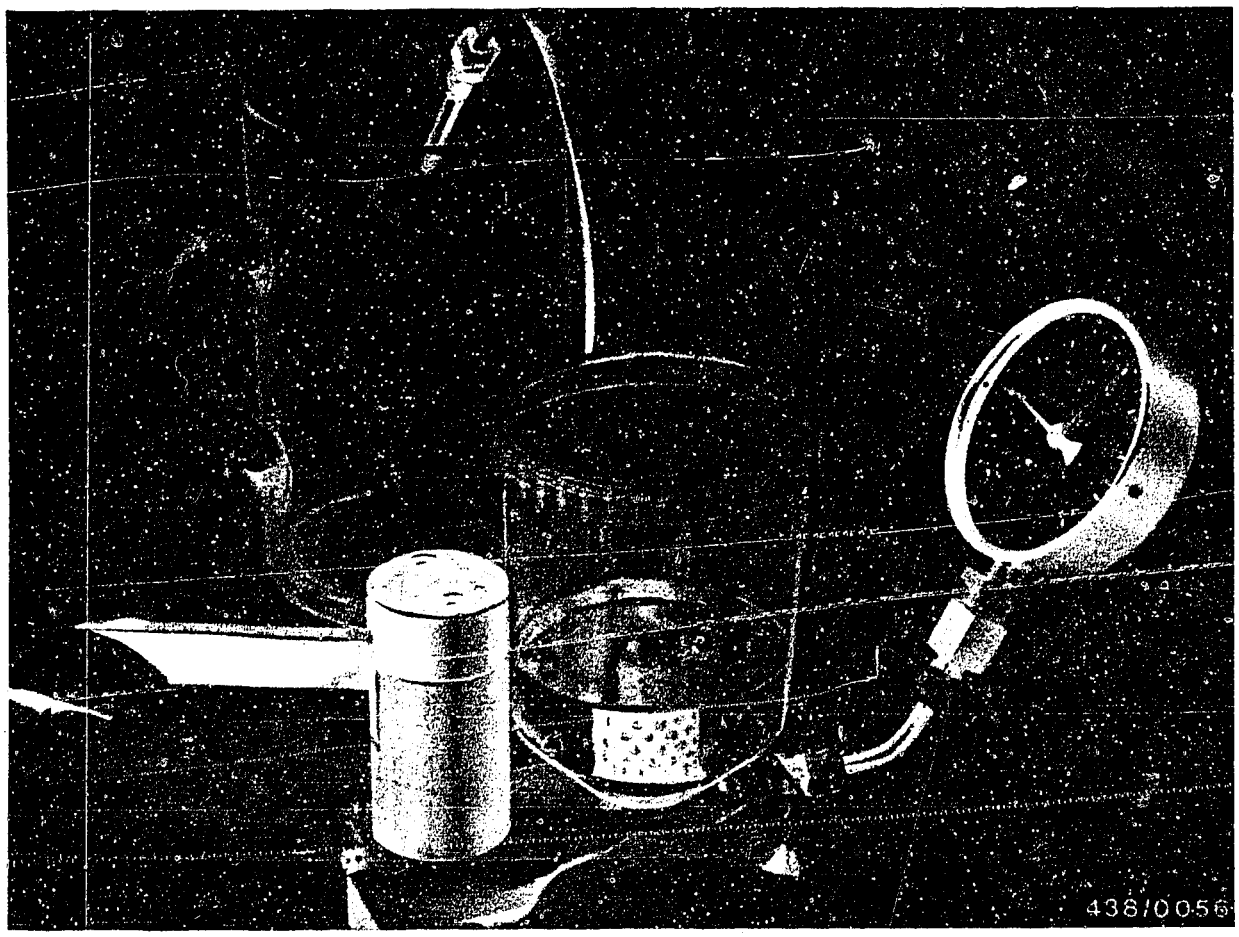
The following testing specification refers to valve testers KDJE-P 400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part No. VS 14 942-CH
Former Part No. 5 973 340 650
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:

Firma
Oskar Gnamm GmbH
D-7531 Kämfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

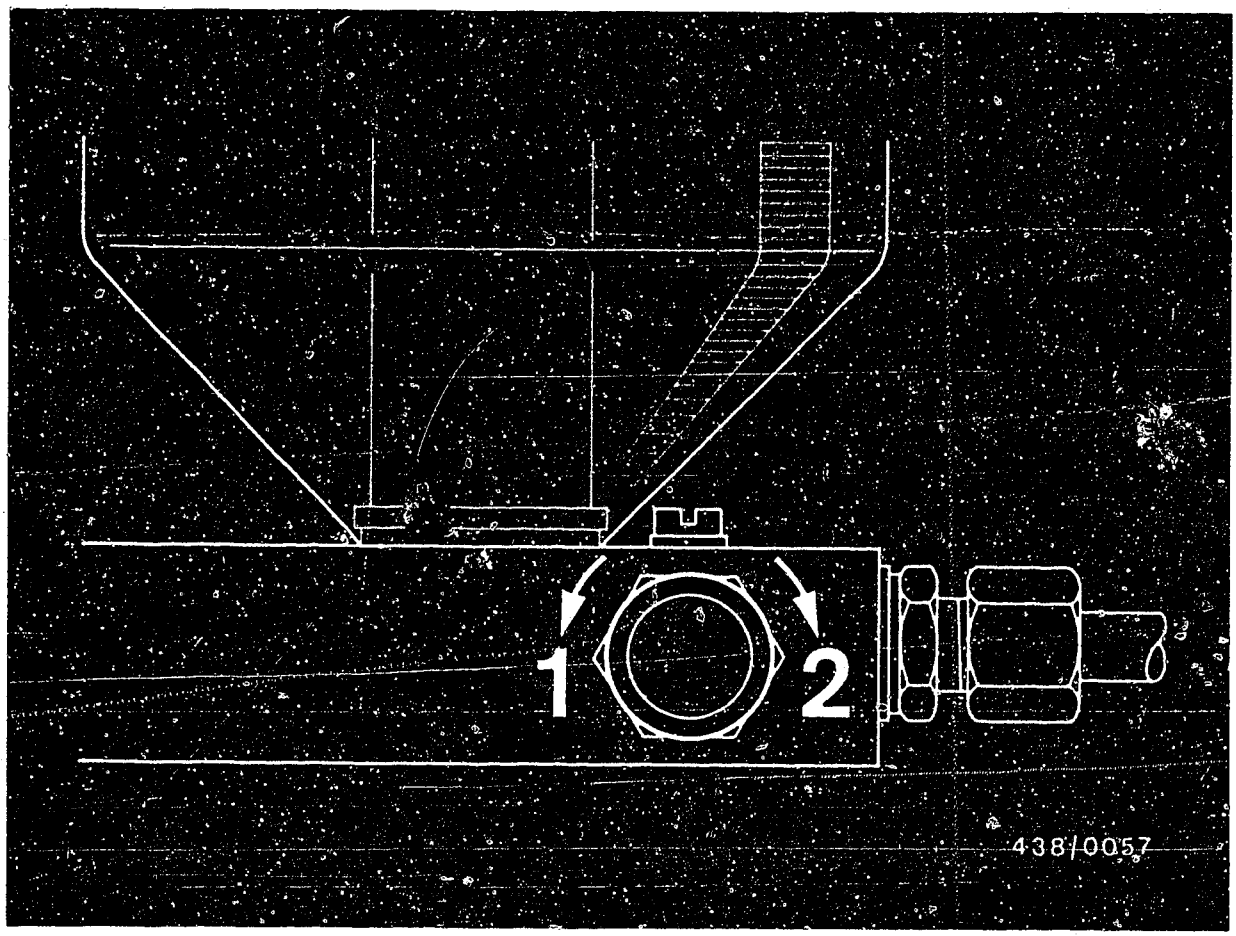


17.2 Connecting the injection valve to the tester

Connect the injection valve to the valve tester and bleed the delivery line by operating the lever several times with the union nut open. Then tighten the union nut.

17.3 Checking for dirt

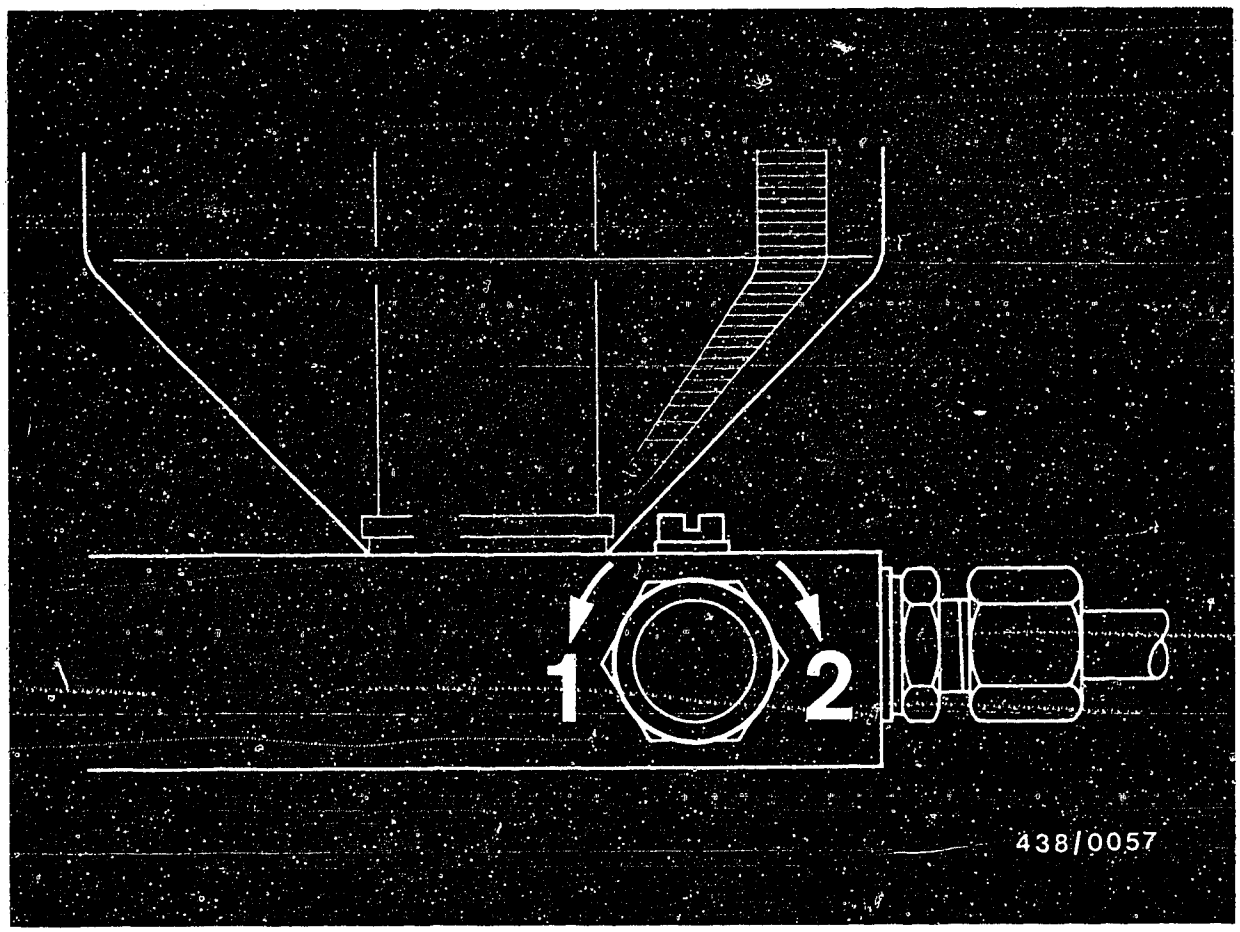
Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it).
You can try to flush the injection valve clear by moving the lever back and forth several times strongly.
If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.



1 = Open 2 = Close

17.4 Testing the opening pressure

Injection valve Part No.	Test specifications - opening pressure (gauge pressure)
0 437 502 011	2,5...3,6 bar (2,6...3,7 kgf/cm²)

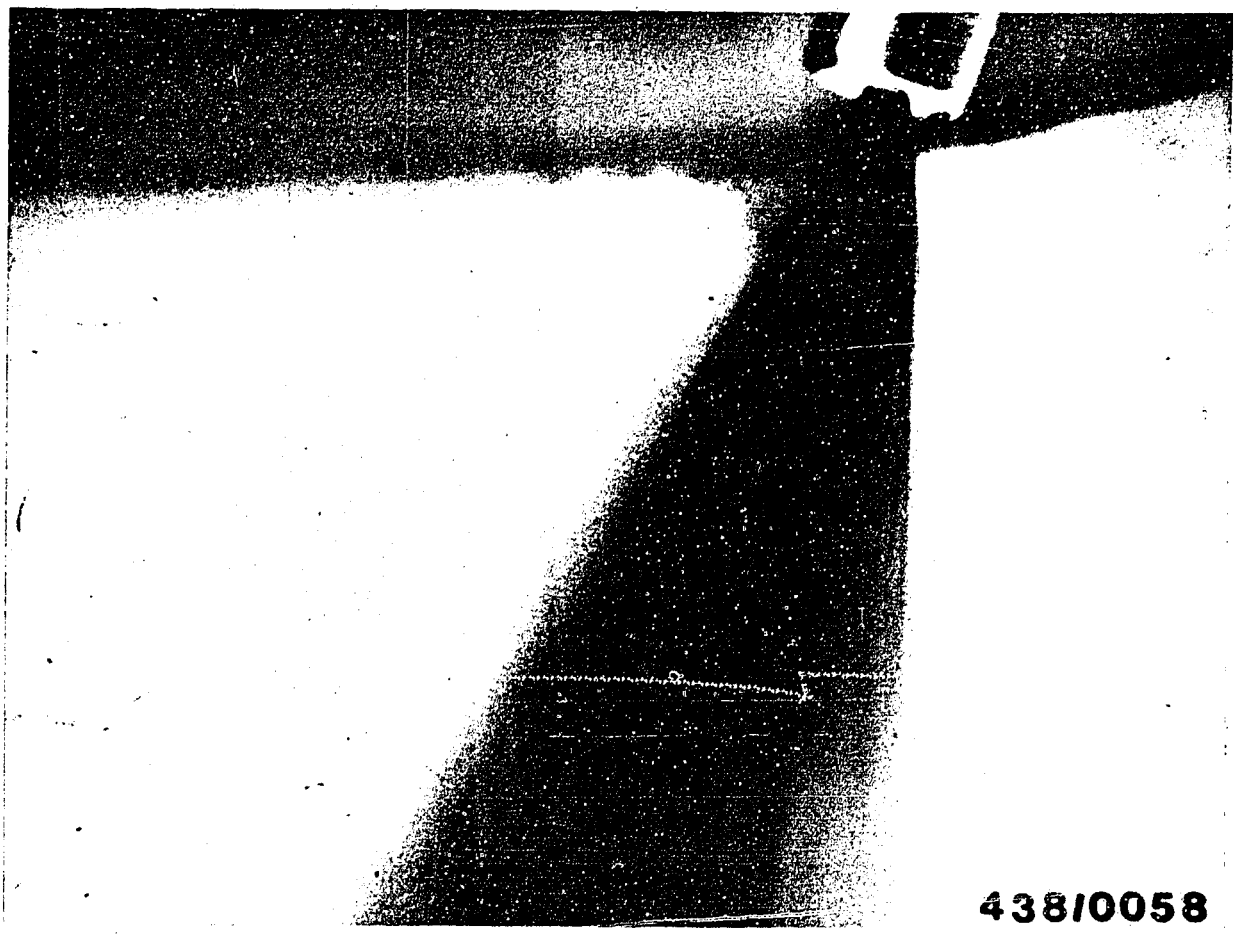


With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (about 2 seconds per stroke).

If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be interchanged within a set.

17.5 Leakage test

Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2,3 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 15 seconds.



17.6 Chatter test, evaluation of spray

Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.

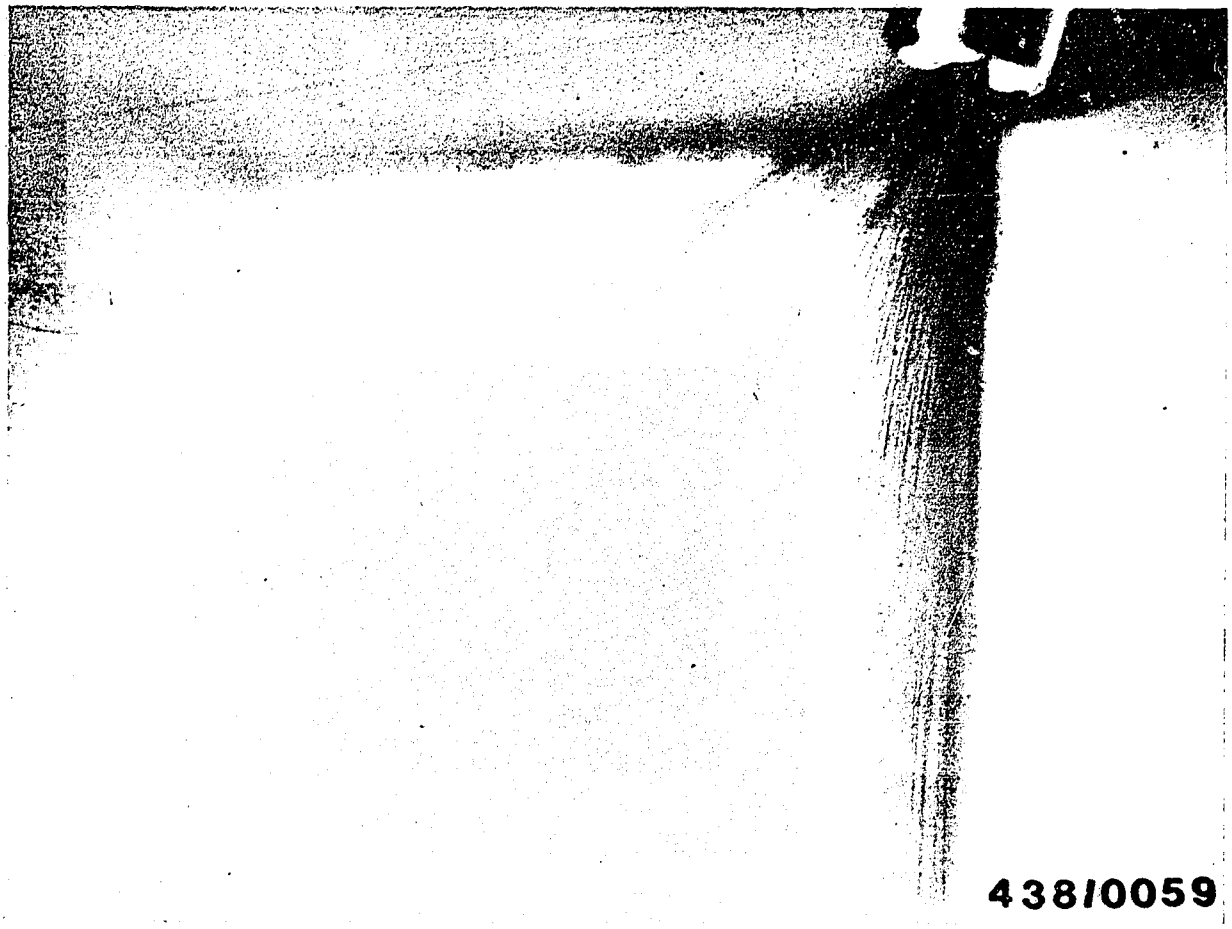
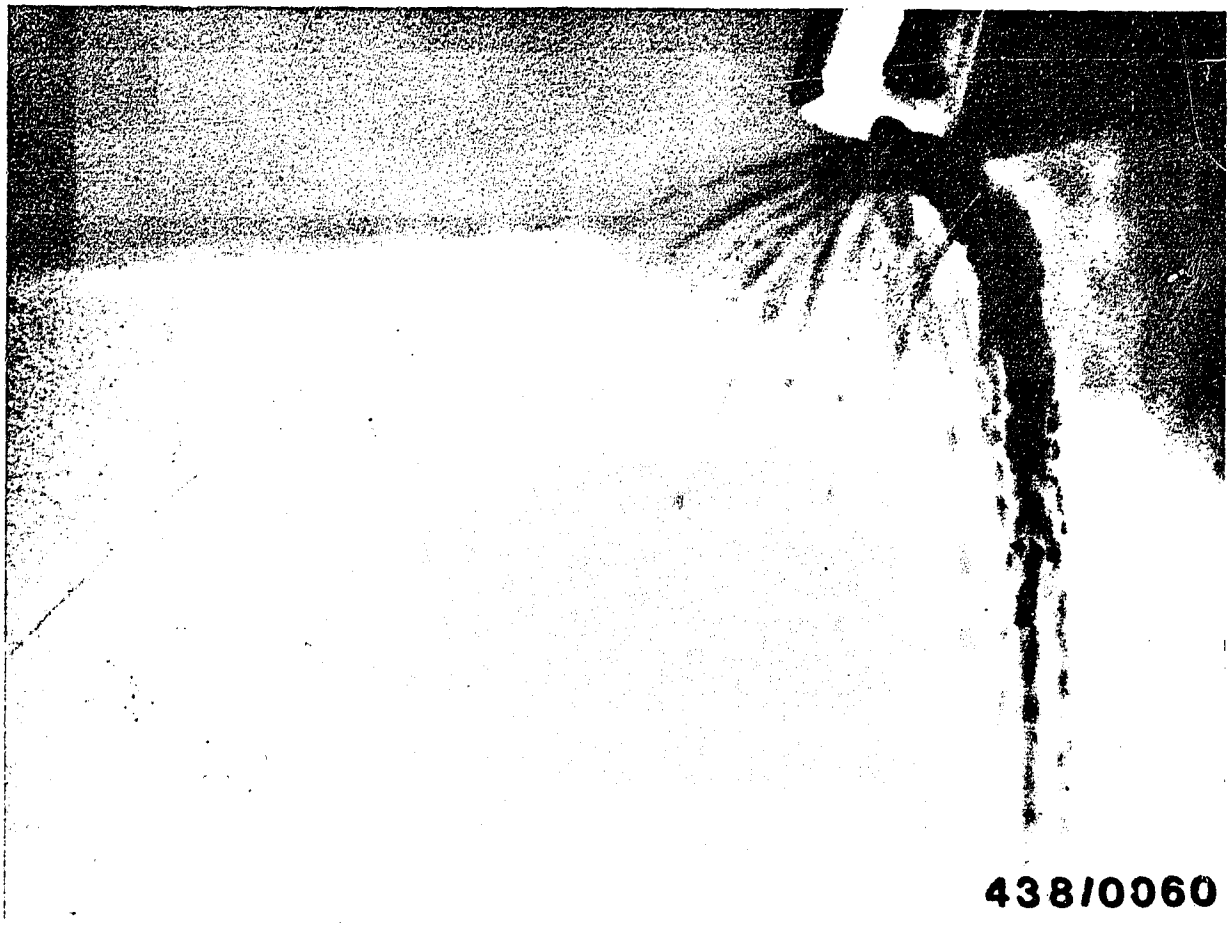


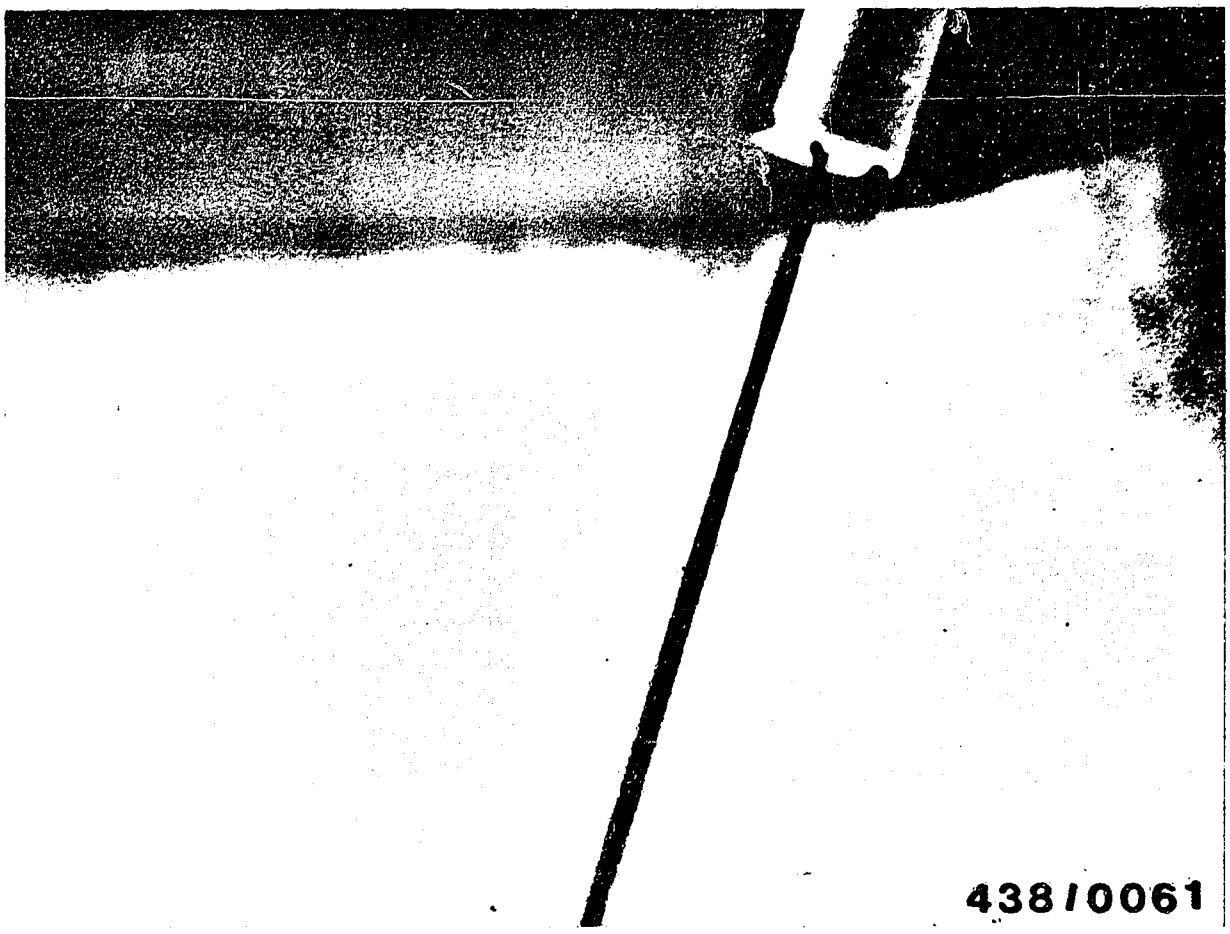
Illustration shows single-sided but nevertheless good spray formation.



438/0060

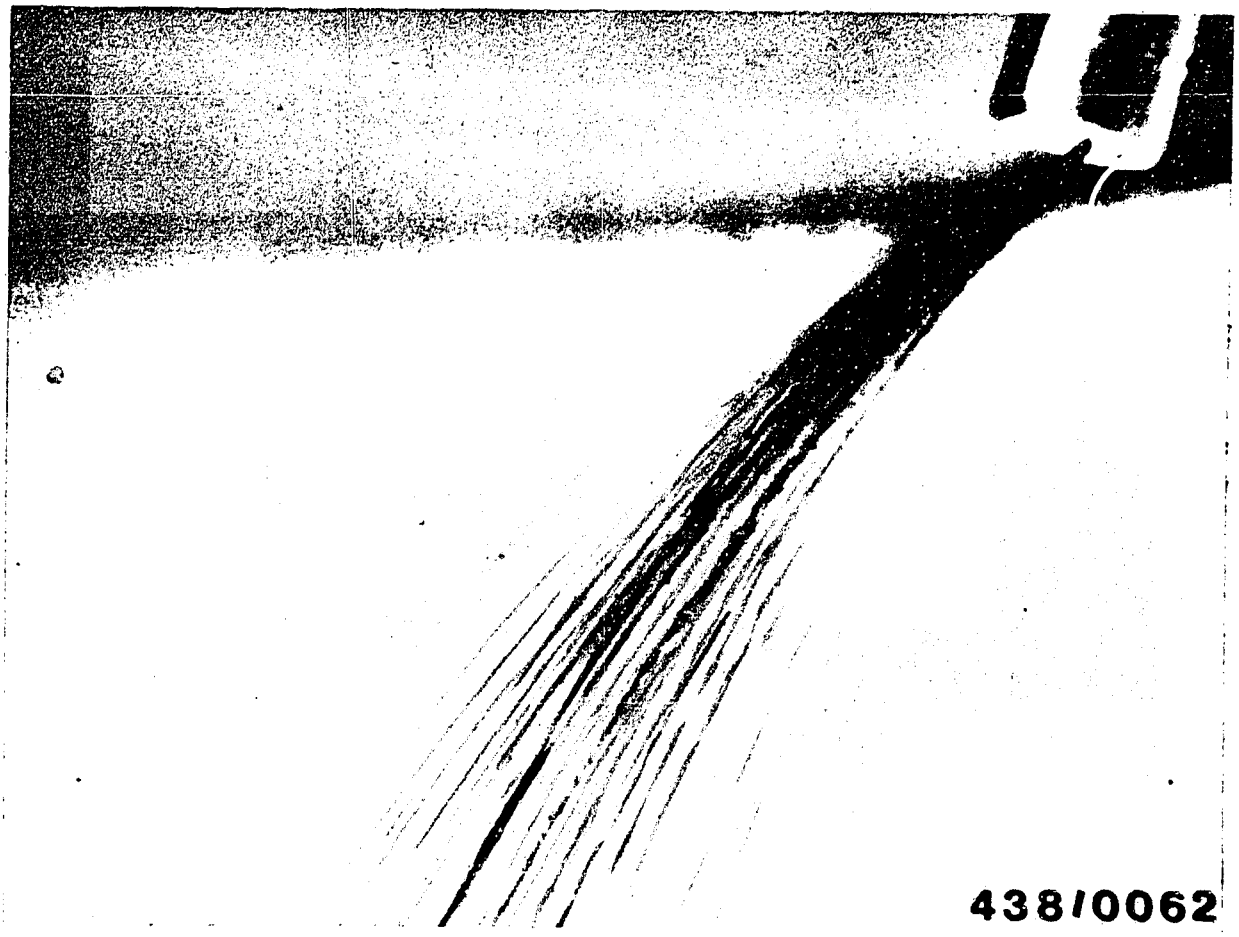
Poor spray formation; replace injection valves.

Illustration shows drop formation.



Poor spray formation; replace injection valves.

Illustration shows "cord" spray.

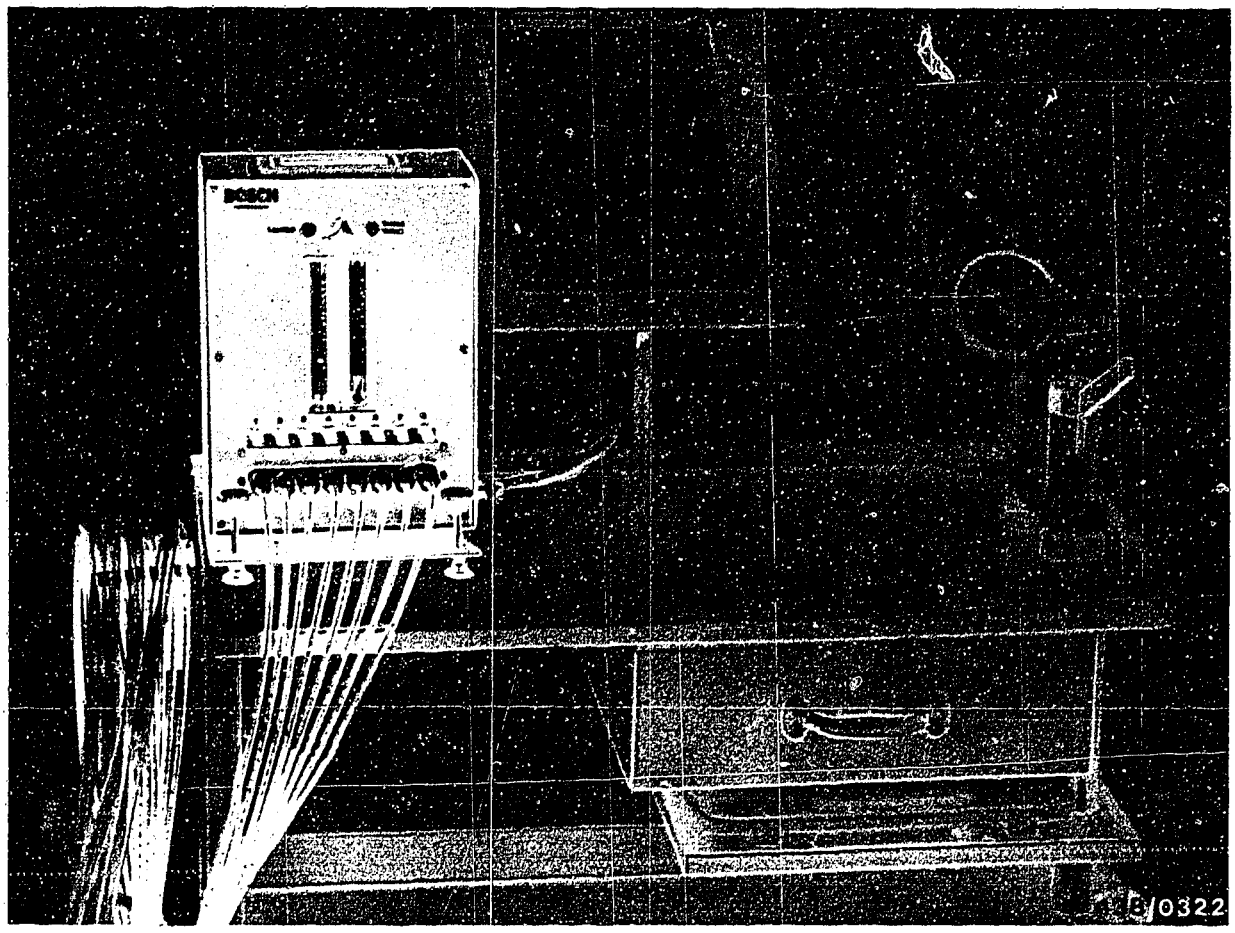


Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates F 6.

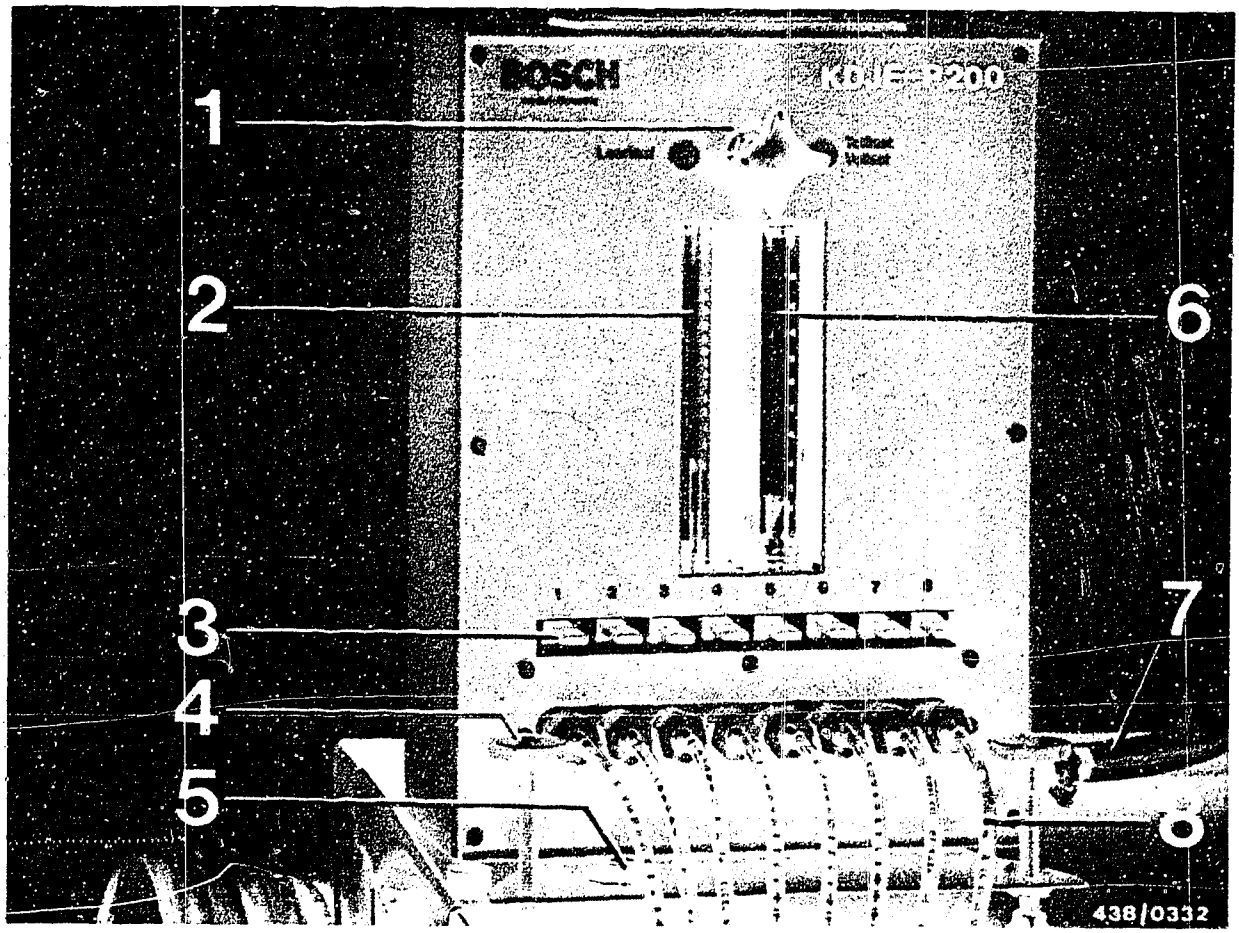


18. Comparative measurement of fuel delivery of fuel distributor outlets.

This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

18.1 Application

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.
The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Polyamide hose lines (test lines)

18.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

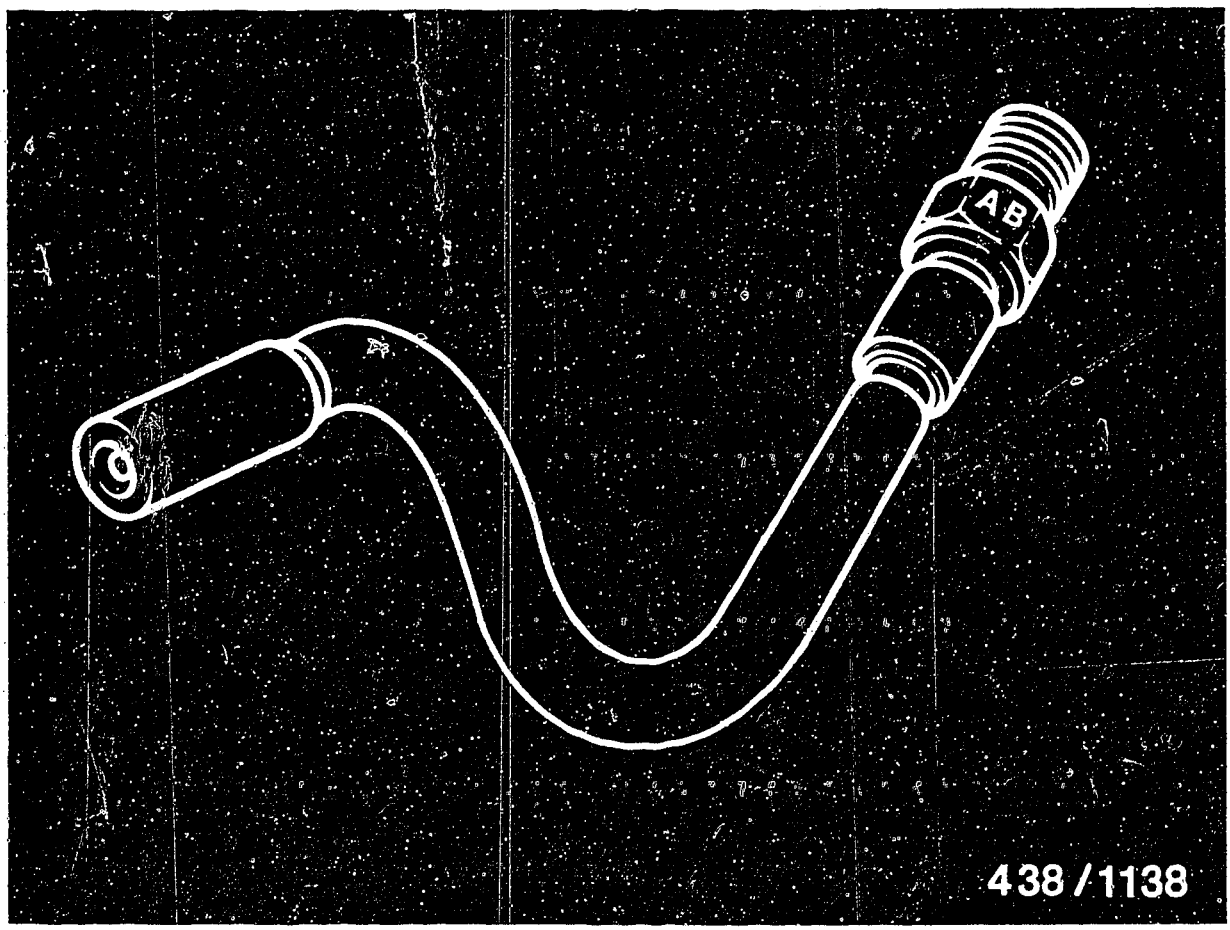
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.



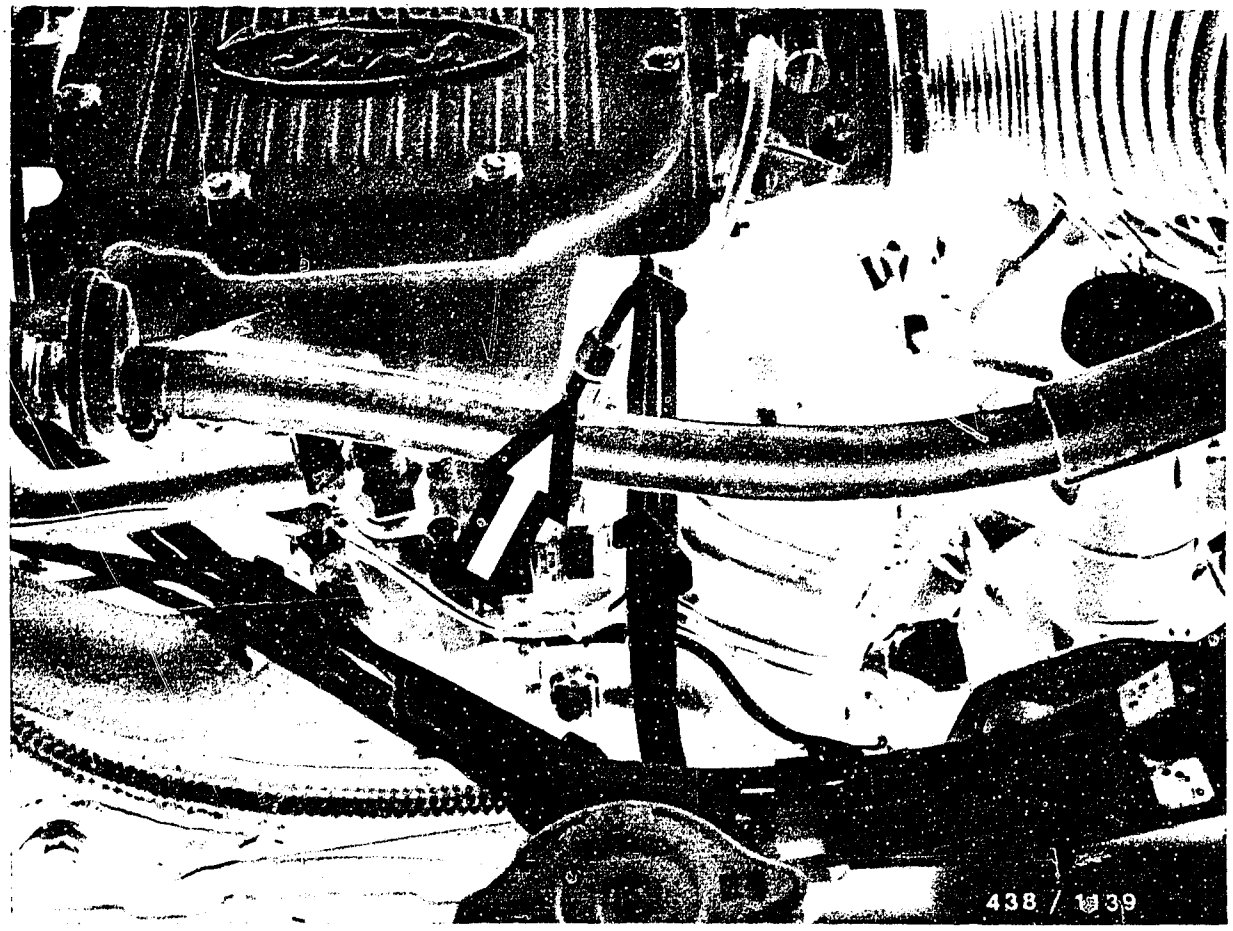
17. Testing the injection valves

Remove injection valves for testing.

Note:

The 1977 model Granada is the only K-Jetronic vehicle with bent injection valves.

However, their operating principle and method of testing is exactly the same as for the known, straight-type injection valve.



Removing and installing the injection valves

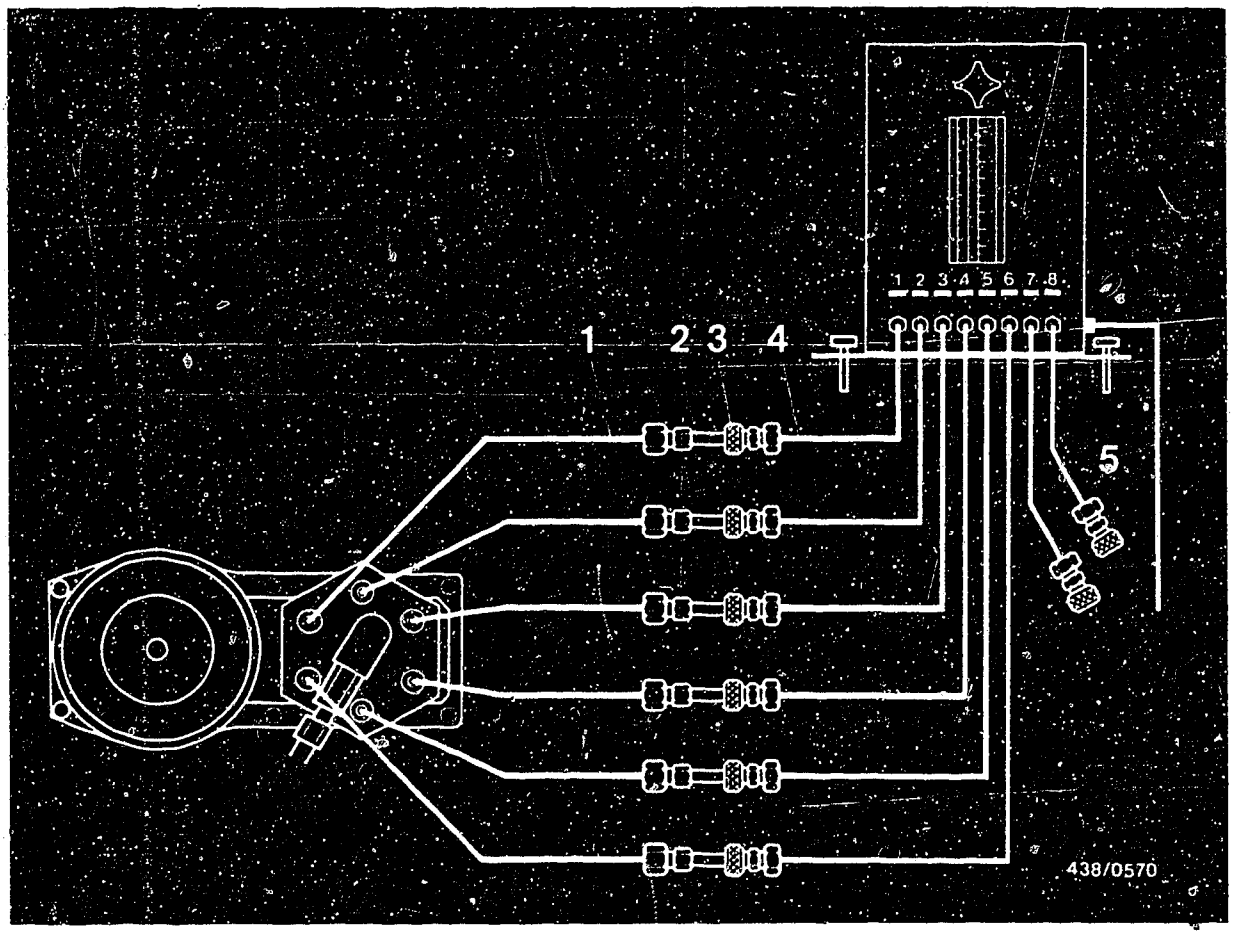
The injection valves are inserted into appropriate mounting holes in the intake ports.

Due to the fact that the injection valves are bent, in the first production vehicles the injection valves can only be removed by removing the air-chamber cover and loosening the air chamber and raising it slightly.

As of 631 date of manufacture the injection valves are modified so that removal and installation is possible without these additional removal operations.

Unscrew injection lines before removing (hold at fixed hexagonal section) and remove injection valves while turning at the same time.

Reconnect injection valves to injection lines after removing.



1 = Injection tubing
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

18.4 Setting up and connecting the tester:

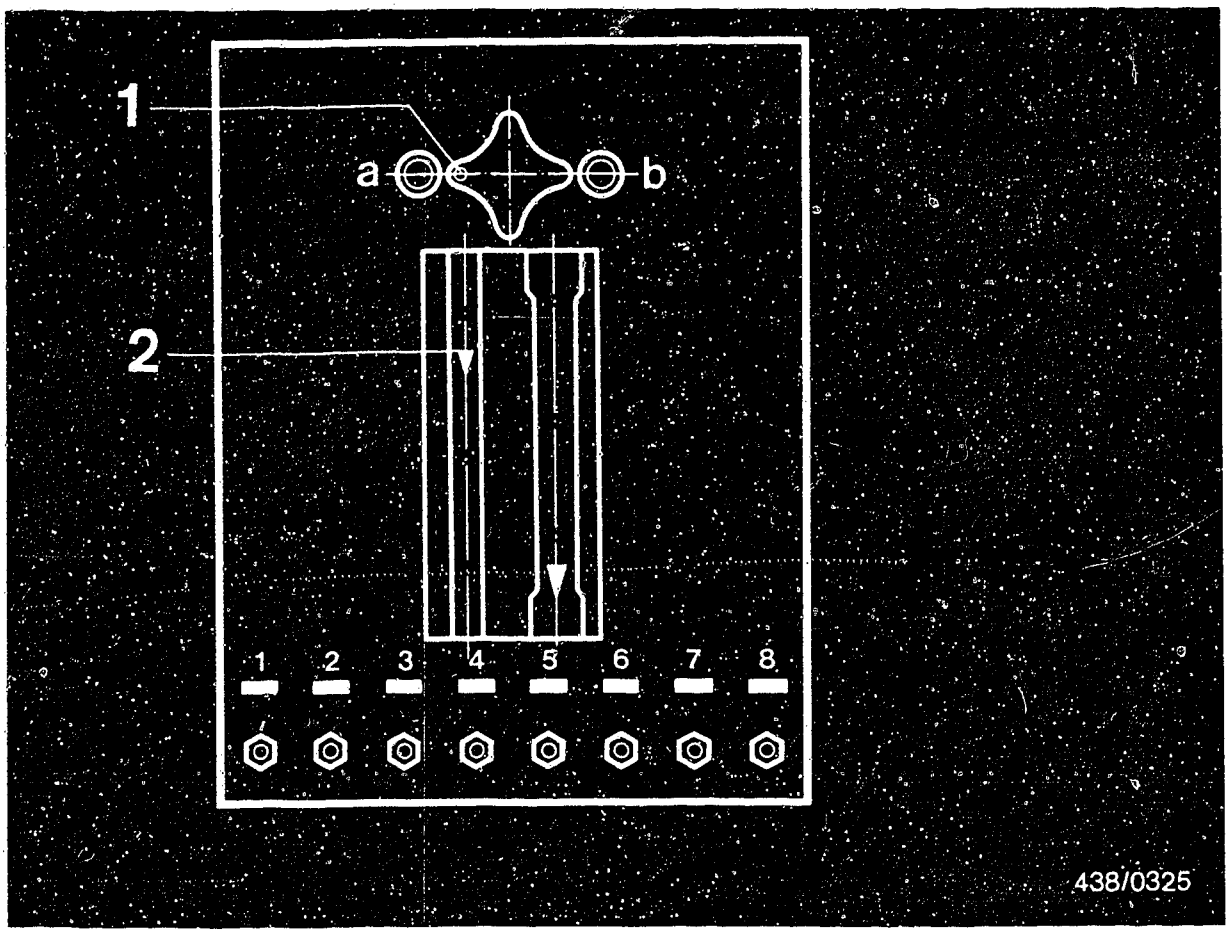
Set the tester up beside the engine on a solid base (e.g. on tester trolley KDJE-W;100) and align it with the built-in spirit level at the base of the tester.

Clean the injection valves with a rag and insert in the appropriate order into the automatic connectors of the first six tester lines.

Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are opened fully.

Introduce the return hose of the tester into the fuel tank filler neck.

18.4 Bleeding the tester:
Remove the air filter so that the air-flow sensor plate becomes accessible.
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.
Switch on the electric fuel pump by bridging the electrical safety circuit.
Press down the air-flow sensor plate to the stop.
Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.
Return the sensor plate to the rest position.

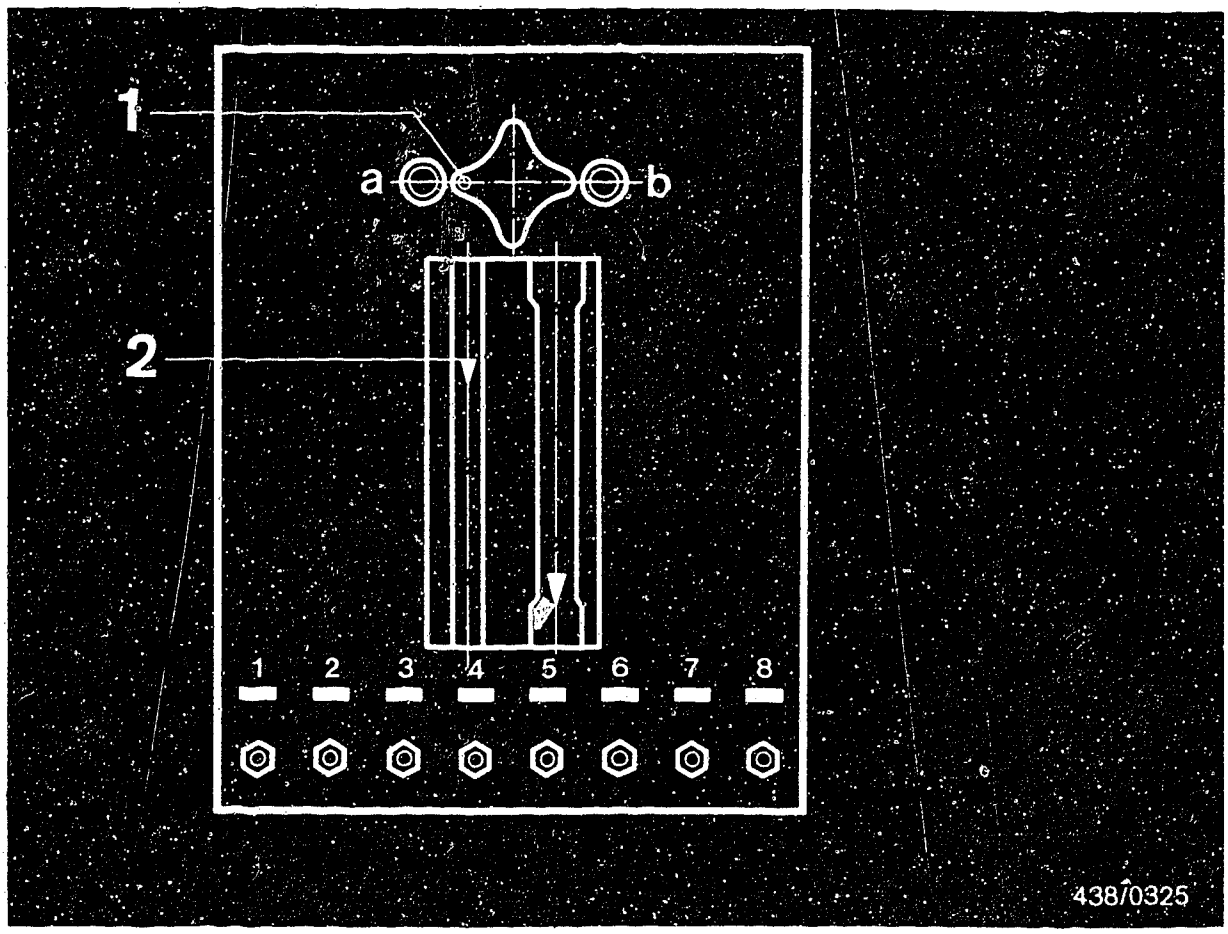


1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

18.6 Testing

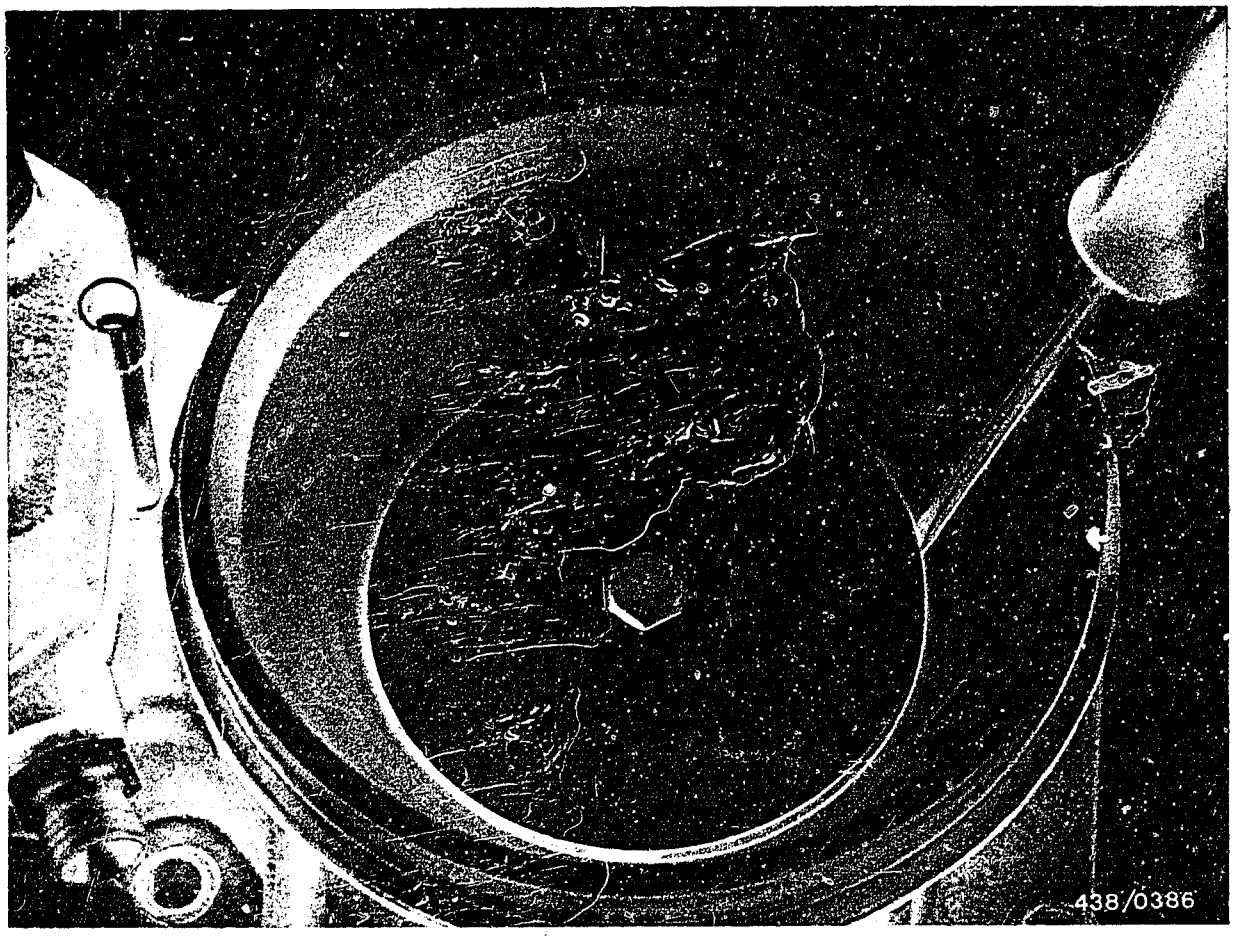
The flow comparison measurement is made in the idle, part-load and full-load ranges.
The small rotameter tube is to be used for the idle measurement (white dot to the left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to the right).



1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2). On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20 ... 30 seconds in the case of small deliveries.



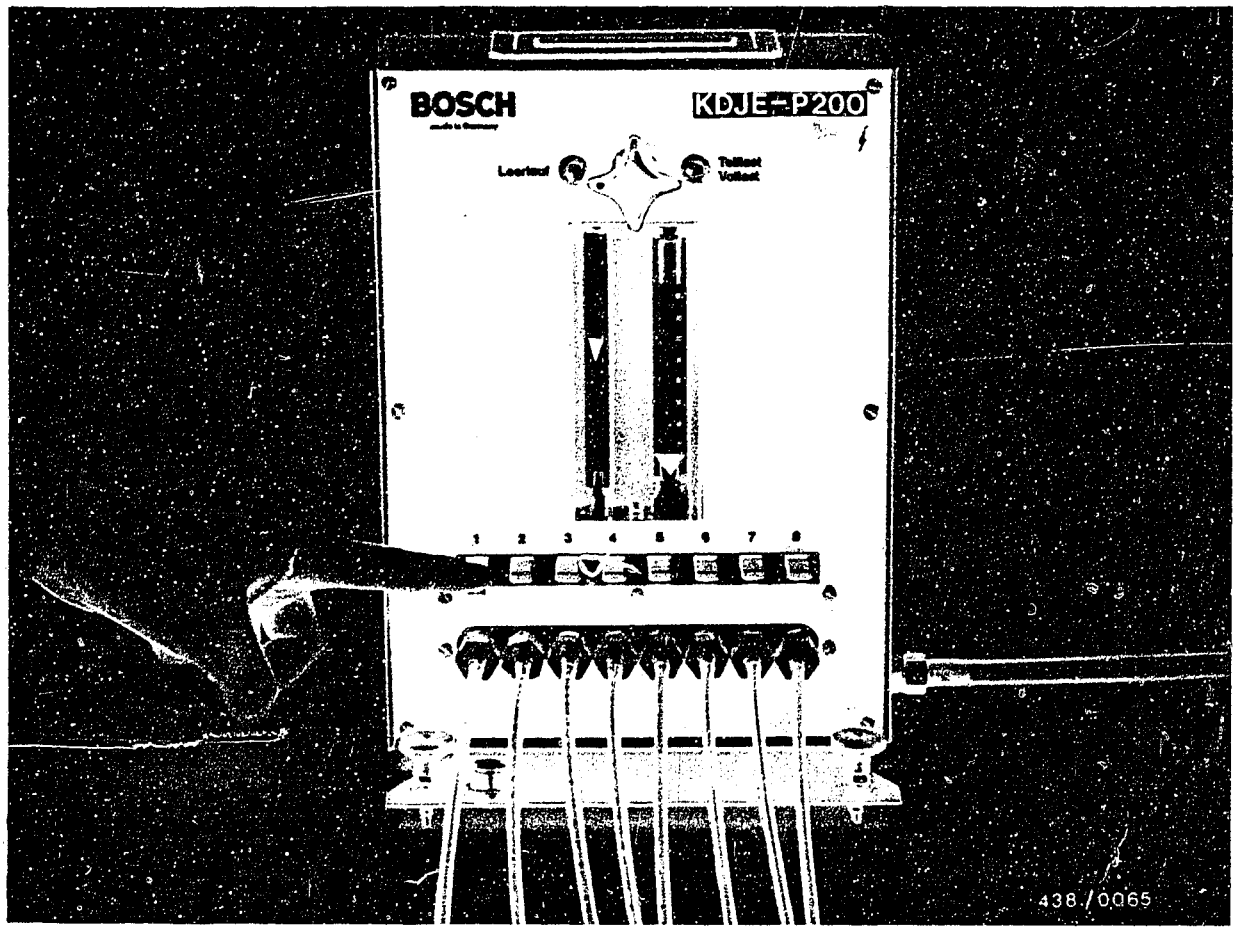
The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using a screwdriver (a small one for the idle position), which is inserted to an appropriate depth between the air funnel and air-flow sensor plate.

Procedure:

Switch on the electric fuel pump by bridging the electrical safety circuit.

Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "setpoint" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.



Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the button of this outlet again and adjust the delivery by correcting the position of the air-flow sensor plate precisely to "setting point", and fix sensor plate in position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

18.7 Test specifications

	Set point cm^3/min	Max. permissible fuel delivery cm^3/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	145.0	158.0

If, in testing, a too large difference is ascertained in one of the three load ranges, the test should for safety's sake be repeated.

If the result is confirmed, you should check whether the fault lies in the fuel distributor or in the injection valves.

To do this interchange the injection valves with the greatest and smallest difference.

If the result is still the same, the fault is in the fuel distributor. If the fault follows the interchanged injection valves, it lies in the injection valves.

Change defective fuel distributor and/or replace defective injection valves.

18.8 Final operations

Check seal rings on stem of injection valves for damage and deformation. If necessary, use new seal rings.

Install injection valves again properly.

Re-mount rubber dome.

Make sure that all lines are laid correctly.

Reconnect electrical safety circuit of K-Jetronic. Make sure that this is done properly.

By means of a trial run, check whether all line connections are leak-tight.

Finally, check the idle adjustment, correcting if necessary (Coordinate F 6).

19. Idle-speed adjustment

19.1 Test conditions:

Warm the engine for adjusting the idle speed (oil temperature approx. 80°C).

Important note:

If the fuel-injection tubing or injection valves were loosened or removed, the engine should be warmed up under load. The low rate of fuel flow during idling is not always adequate to drive all the air out of the fuel-injection tubing.

The idle speed must not be adjusted when the engine is too hot, e.g. immediately after being raced or after a power measurement on the roller-type test stand.

In vehicles with an air-conditioner, this should be switched off to stabilize the engine speed during idle-speed adjustment.

Rotational-speed measurement with separate tester.

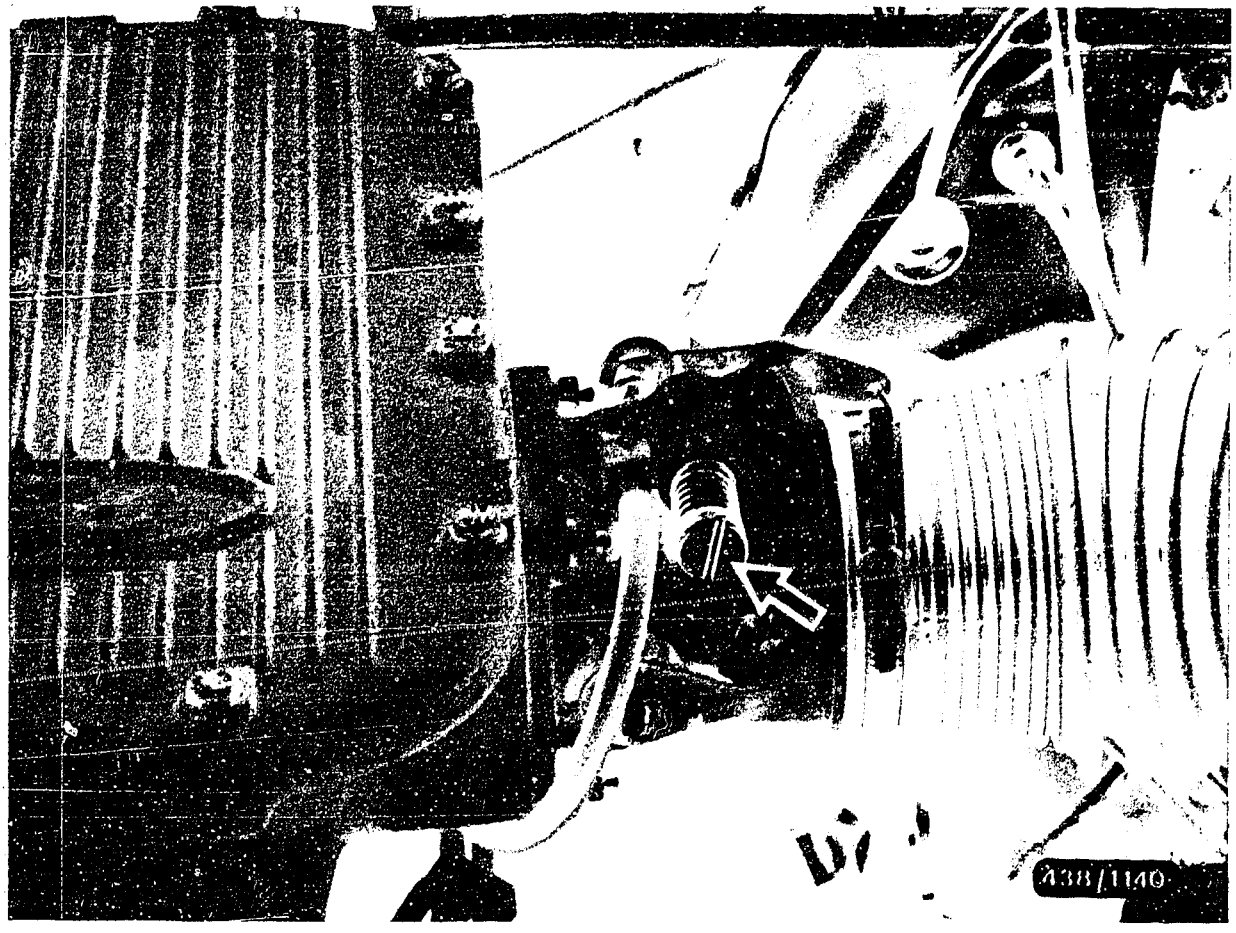
Check that the throttle-plate lever makes contact with idle stop. The cable should be free of tension.

19.2 Test specifications for idle adjustment

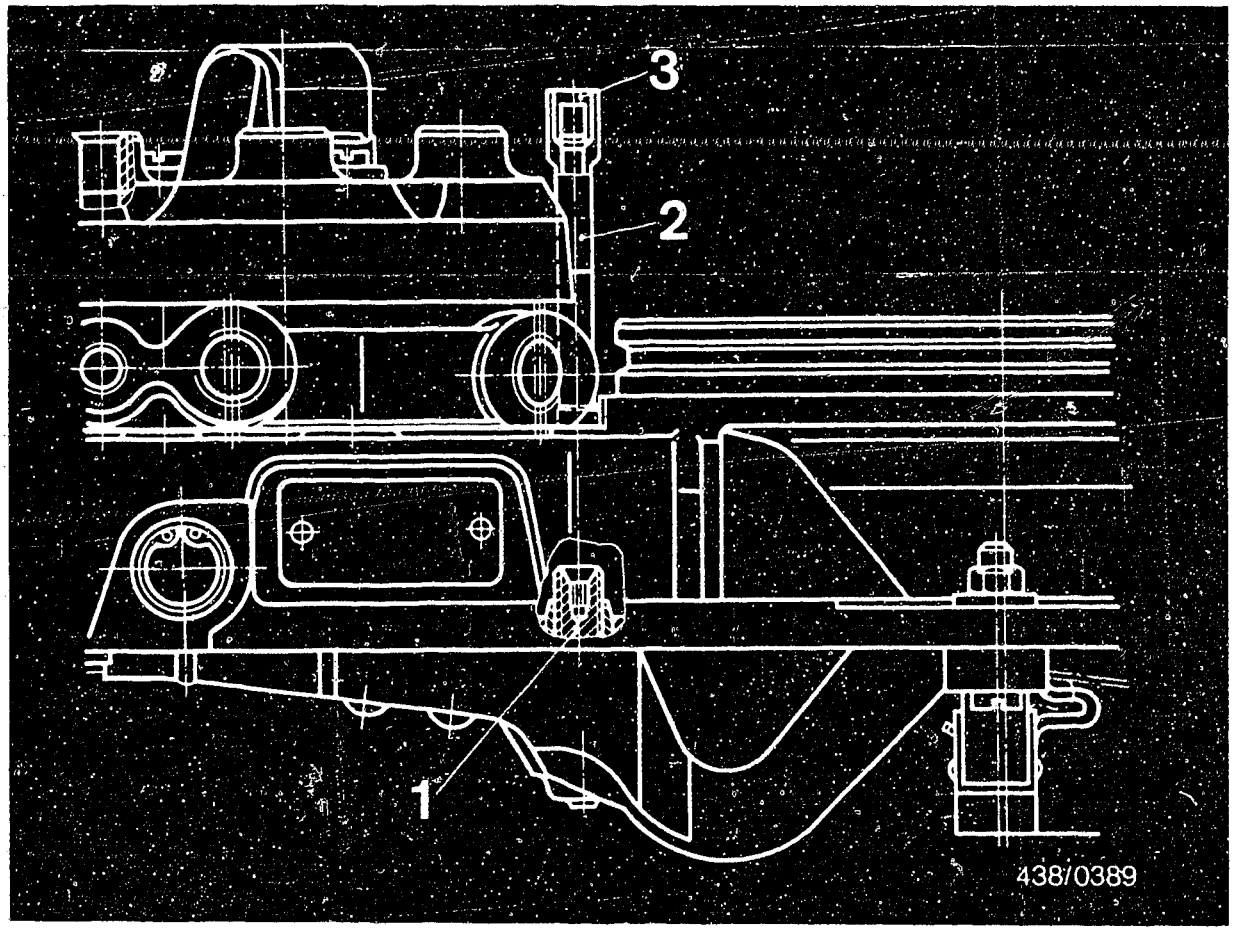
Idle speed: 775 ... 825 min^{-1}

CO concentration: (% by vol.) 2.0 ... 2.5

Note:
Before assessing the idle speed and CO concentration, let the engine run for approx. 30 seconds at a speed of 3000 min^{-1}.
Then wait until the readings have settled.
This procedure should be repeated if the adjustment operation takes longer than approx. 30 seconds.



The idle speed is adjusted at the bypass screw on the throttle-valve assembly (arrow).



Adjusting the CO concentration

The CO concentration is adjusted by turning the idle-mixture-adjusting screw (1) in the mixture-control unit using the adjusting wrench KDEP 1035.

After removing the safety cap (3) of the guide tube (2), the adjusting wrench is passed through the guide tube and inserted into the idle-mixture-adjusting screw.

Turning to the right = richer mixture
Turning to the left = leaner mixture

Caution:
Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary and then turn it to the right up to the setting required.

After every adjustment remove the adjusting wrench and accelerate the engine briefly, so that the air-intake system can cool off. Then wait until the indicator of the CO tester has stabilized. Never accelerate the engine with the wrench still in place as this could result in bending the control lever in the air-flow sensor.

19.3 Anti-tamper device for idle-mixture adjusting screw

In the Federal Republic of Germany, § 47 of the FMVSS/ CUR, "Exhaust Gases and their Discharge", has been amended. This amendment order was printed in full in the Verkehrsblatt 13 of 15th July 1975.

Accordingly, all motor vehicles with externally supplied ignition produced as of 1 October 1976 must be provided with anti-tamper devices for the idle-mixture adjusting screw so that it is not possible to adjust the screw without destroying the anti-tamper device. The intention is to prevent non-experts from re-adjusting the idle setting and thus inadmissibly influencing the exhaust gas. Consequently, the anti-tamper caps may only be used in the workshop and must not be sold to customers for their own use.

These anti-tamper caps come in different colours. The cap to be used for the after-sales service of updraft air-flow sensors is red.
It can be obtained from Bosch under the part number 3 430 522 002.

The anti-tamper device for the air-flow sensor is removed and fitted using special tools (e.g. No. 131 090 from Cartool Co., Hans Schubert AG, Unterer Grasweg 88, D-8070 Ingolstadt).

After-sales Service

Technical Bulletin

Continuous Injection System mixture control-unit

VDT-I-438/100 B

Ed. 2 7.1975
Translation of German edition of 1.7.1975

The mixture control unit is still being reported as one defective unit in warranty claims. We wish to point out expressly that the mixture control unit consists of two separate products, the air-flow sensor and the fuel distributor, and that there are separate defect numbers for them in the warranty manual. Please report only the defective product.

Accessory Sets

Various fuel distributors and warm-up regulators have been supplied up to now with pressed-in plug connectors. These will no longer be supplied in future.

	no longer available	Replacement + accessory set
Fuel distributor	0 438 100 002	0 438 100 017
	0 438 100 003	0 438 100 005 + 2 437 001 001
	0 438 100 004	0 438 100 017
Warm-up regulator	0 438 140 002	0 438 140 004 + 1 437 000 000

The accessory sets contain the required number of tailpieces and seal rings.

Please note: the accessory set 2 437 001 000 is delivered included with the fuel distributor 0 438 100 017, and does not therefore need to be ordered separately.

Electric Fuel Pump

In the Technische Mitteilung VDT-BMO 114/1 B and the Service Information sheet VDT-I-740/2-1 B 1st. supplement, we announced that the non-return valve can be replaced on the electric fuel pump 0 580 254 996. We have come to the conclusion from the warranty claims that not enough use is being made of this possibility. Please bear this fact in mind and repair leaky electric fuel pumps before deciding to replace the entire assembly.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

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After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10. 1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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After-sales Service

Technical Bulletin

Securing of idle-speed adjusting screws

K-Jetronic (CIS)

438

VDT-I-438/102 B
11.1976

According to a statutory regulation, changes have been made to § 47 of the German traffic licensing laws concerning exhaust gases and their outlets. This regulation was printed in full in traffic law sheet 13 of 15.7.75 .

Consequently, all motor vehicles with external-ignition engines must have their idle-speed adjusting devices secured from the 1st October 1976, so that adjustment of the screw is impossible without destroying the securing device. This should stop unskilled people from adjusting the installation of the idle-speed system and thereby illegally influencing the emission values. As from now, securing caps can only be used in the workshop and cannot be sold to customers for their own use.

Securing caps are produced in various colors. For after-sales service the following caps and colors are used:

downdraft air-flow sensor
Blue — securing cap is not available from BOSCH. Part number is DB 000.997.59 86 from the Deutsche Vergaser Gesellschaft K 34 520

updraft air-flow sensor
Red — Part number 3 430 522 002

These stipulations are only valid in countries where ECE regulations (Economic Commission for Europe) apply. The air-flow sensors must however be converted for the use of these securing caps, as a matter of principle. The caps can also be used in countries not subject to ECE regulations, to prevent dirt penetrating through the pipe to the adjustment in the case of updraft air-flow sensors.

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After-sales Service

Technical Bulletin

EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254 ..

VDT-I-438/104 En
3.1983
(Replaces Ed. 5.1982)

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal
0 580 254 001	1 587 010 500	---	---
002	500	---	---
0 580 254 003	502	---	---
004	502	---	---
005	502	---	---
006	502	---	---
007	500	---	---
948	005	---	---
949	002	---	---
950	006	---	---
951	006	---	---
952	002	---	---
953	501	---	---
954	002	---	---
956	002	---	---
957	002	---	---
958	002	---	---
959	002	---	---
960	002	---	---
961	002	---	---
962	002	---	---
963	005	---	---

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Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal ring
0 580 254 964	1 587 010 002	---	---
965	002	---	---
966	002	---	---
967	002	---	---
968	002	---	---
969	002	---	---
970	002	---	---
971	002	---	---
972	002	---	---
973	002	---	---
974	002	---	---
975	003 ④	---	---
976	004 ③	---	---
977	004 ③	---	---
978	1 587 410 901	---	---
979	010 004 ③	---	---
980	002	---	---
981	002	---	---
982 ①	003 ④	---	---
982 ②	1 587 410 901	---	---
984	010 004 ③	---	---
985	---	1 583 385 006	1 580 203 002
986	---	386 011	001
987	---	008	001
988	---	008	001
989	---	008	001
990	---	385 004	002
991	---	004	002
992	1 587 010 001	---	---
996	---	386 011	001
998	---	385 004	002
9 580 234 003	002	---	---
005	002	---	---

1 = up to FD 822 2 = from FD 823

3 = Parts set ..003 also possible (delivery-line connection at 90°)

4 = Parts set ..004 also possible (delivery-line connection axial)

After-sales Service

Technical Bulletin

HOT-STARTING PROBLEMS

438

VDT-I-438/105 En
3.1980

Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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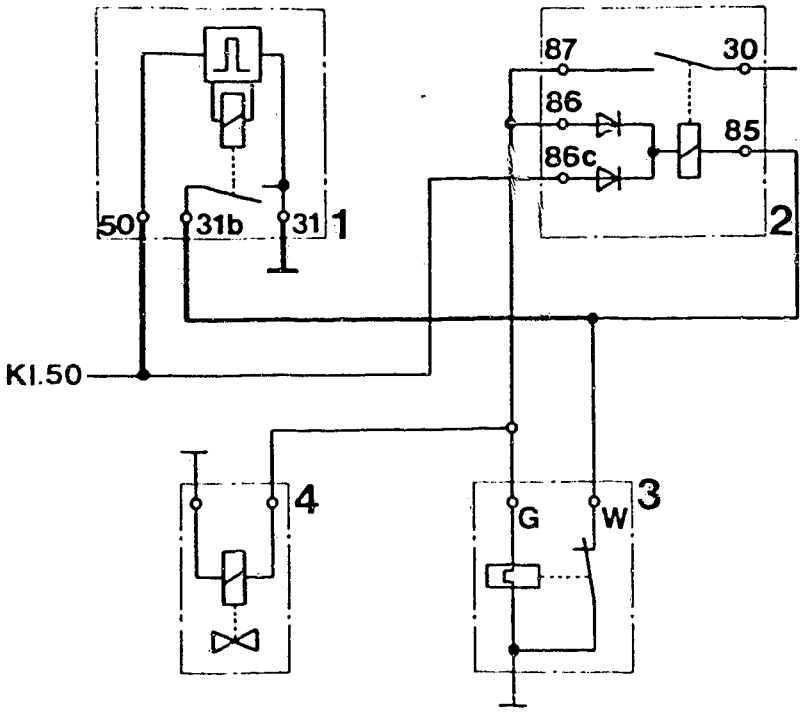
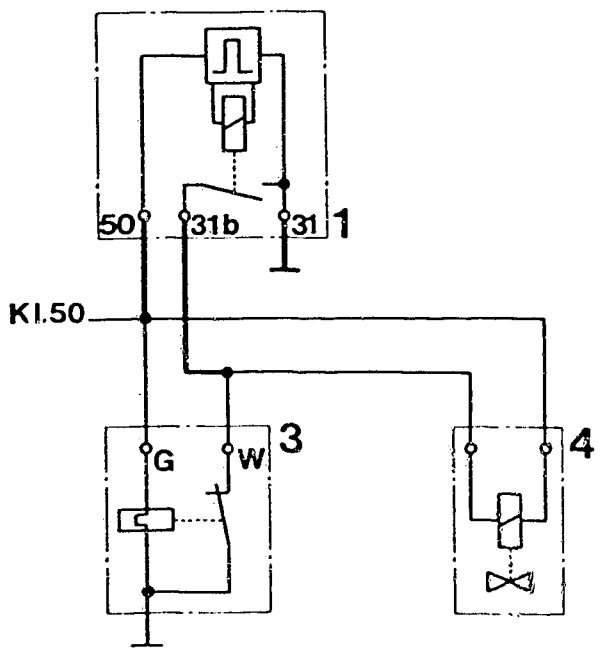


K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

After-sales Service

Technical Bulletin

FIRMLY FITTED NON-RETURN VALVE

VDT-I-438/107 En

Repairs
fuel pumps 0 580 254 ...

5.1980

Previously fuel pumps with non-exchangeable non-return valve (see VDT-I-438/104 En) had to be exchanged completely in cases of leakage in the non-return valve.

If the fuel pump is in working order and only the non-return valve leaks, there is now the possibility of repairs as part of after-sales service. 2 parts sets have been produced for this purpose, they contain, amongst other things, a tube fitting with built-in non-return valve.

Before using the parts set the installation conditions should be checked. The defective non-return valve can remain in the fuel pump which does not have to be dismantled for fitting the parts set. Before disconnecting the fuel lines the pressure fittings of the fuel pump and the fuel lines should be thoroughly cleaned.

Description and fitting

Parts set 1 587 010 003 for fuel connection with inlet union.

Screw the tube fitting (short side) with the thick flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Place the thin flat seal ring, the fuel-line inlet union and the other flat seal ring on to the long side of the tube fitting and tighten with the hexagon cap nut. Run the engine and check that there are no leaks in the connection.

Parts set 1 587 010 004 for fuel connection with nipple and union nut.

Screw the tube fitting with flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Screw the fuel line to the tube fitting with a union nut and tighten. Run the engine and check that there are no leaks in the connection.

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After-sales Service

Motor Vehicle Service Information

HOT-STARTING PROBLEMS

on vehicles fitted with Jetronic

VDT-I-Gen. 050 En
9.1982

Customer complaints

If the vehicle is parked and the engine switched off after having been run at normal operating temperature, it often occurs that the engine proves difficult to start, or won't start at all, and when it does start it runs extremely roughly (only on 2 or 3 cylinders). The engine has to be accelerated a number of times before it runs smoothly.

Causes

For economic reasons ("stretching" of the mineral-oil reserves), it can happen that alcohol in varying quantities has been added to gasoline. Methanol is used for instance.
Such alcohol-added fuels, depending upon the amount of alcohol, adversely affect the hot-starting characteristics of the engine. The addition of alcohol raises the vapor pressure of the fuel and the result is that the boiling point of the alcohol-fuel mixture drops. This in turn leads to the formation of fuel-vapor locks in the fuel system when the engine has been switched off.

This means that when starting, and during the subsequent idle period, the air-fuel mixture is temporarily too lean.

Remedies

- Check the ignition and Jetronic systems, particularly for leaks.
- Changing to another brand of gasoline can sometimes cure the problem immediately.
- In many cases, fully depressing the gas pedal helps during starting, as does slightly depressing the gas pedal during the idle period until the engine runs smoothly.
- Fit the pulse relay 0 340 000 003 (refer also to VDT-I-438/105) in vehicles with K and D-Jetronic.
  This step, though, will still not fully alleviate the rough running of the engine during the starting off phase

Note:

The pulse relay 0 340 000 003 is NOT to be installed in vehicles fitted with L-Jetronic.

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After-sales Service

Motor Vehicle Service Information

COLD START - WARM UP
ACCELERATION PROBLEMS

VDT-I-Gen. 051 En
10.1982

in vehicles with Jetronic

Customer complaints

- Starting problems with a cold engine
- Engine bucking during warm up
- Uneven idle (speed fluctuations)
- Engine cuts out during acceleration (flat spot)
- Loss of output

Cause

When the ignition and the Jetronic have been checked and the test specifications given have been reached, a possible reason for the problems quoted could be coke residue on the intake valves.

The carbon residue thus present delays a continuous flow of fuel from the injection valve to the combustion chamber on account of its sponge effect.

As a result of this the air-fuel mixture can in some cases be so lean, that it can no longer be ignited.

Loss of output results from a reduction in the amount of cylinder filling and is caused by a very high coking.

Complex connections between qualities specific to the engine, the engine oil and fuel used, as well as relevant driving cycles (e.g. mainly short stretches) can cause such coking on the intake valves.

Remedy

Dismantle the intake valves and remove the deposits.

Please note

Various vehicle manufacturers are working at the moment on other measures, such as cleaning with additives. Results of these tests are not yet available.

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Motor Vehicle Service Information

LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits.
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

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After-sales Service

Motor Vehicle Service Information

FORD GRANADA 2.8 i GL
with K-Jetronic
as from chassis no. TJ 49804
up to date of manufacture January 1977

VDT-I-FOR 006 En
3.1984

Wiring harness for thermo-time switch

When the wiring harness was manufactured for the above-mentioned vehicles, the connections G and W in the plug housing of the thermo-time switch were incorrectly transposed.

During cold starting, this leads to a direct connection of terminal 50 with ground via the switching contact of the thermo-time switch. After several attempts are made at starting, the thermo-time switch will be destroyed.

When starting problems occur with these vehicles, you should first check to see whether the terminals have, in fact, been correctly connected.

Disconnect the plug from the thermo-time switch and from the start valve. When starting (positive to terminal 50), check with the test lamp from terminal W or G of the wiring harness to ground. If the test lamp lights up, then this is cable 50 for connection G. If necessary, transpose the contact blades in the plug and replace the thermo-time switch.

Fig. 1
Electrical circuitry of the cold-start device
1 = start valve
2 = thermo-time switch

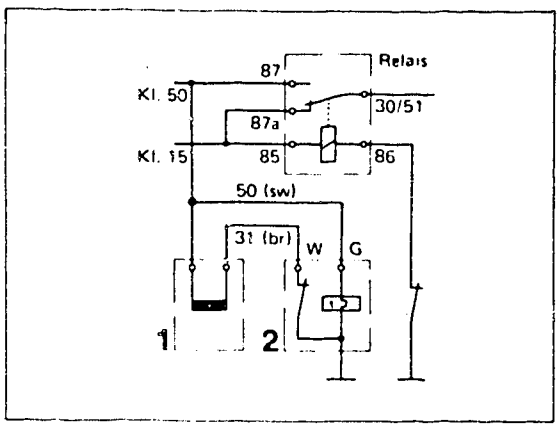
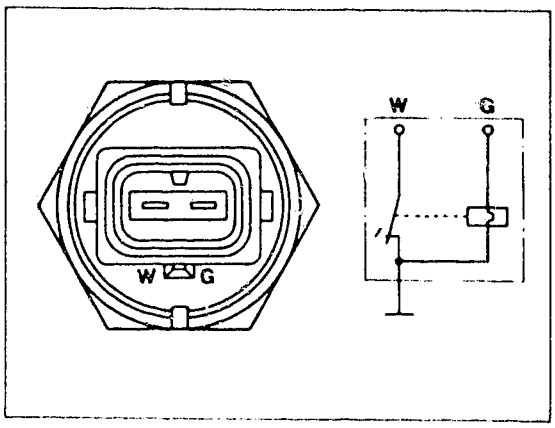


Fig. 2
Terminal connections of the thermo-time switch



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Push the plug onto the thermo-time switch and the start valve.

The thermo-time switch has part number 0 280 130 214.

Vehicles in which the cable to the thermo-time switch bears a red band, have already been converted in the factory.

Warranty procedure

The work described should be carried out and charged to the customer. The customer should, however, be informed that he can take this bill to a Ford dealer who will then reimburse him with the appropriate amount.

Table of contents

Table of contents (continued)

Table of contents (continued)

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